Registered at the G.P.O. for Transmission to Canada by Magazine Post.

Vol. 44. Ser. A. Part 8. pp. 253–284. AUGUST, 1956.

THE REVIEW OF APPLIED ENTOMOLOGY

SERIES A: AGRICULTURAL.

ISSUED BY THE COMMONWEALTH INSTITUTE OF ENTOMOLOGY.

LONDON:
COMMONWEALTH INSTITUTE OF ENTOMOLOGY,
56, QUEEN'S GATE, S.W.7.

Price 4s. net.

All Rights Reserved.

Digitized by the Internet Archive
in 2024

https://archive.org/details/review-of-agricultural-entomology_1956-08_44_part-8

SCHERNEY (F.). **Zur Biologie der an Raps vorkommenden Meligethesarten.** [Contributions to the Biology of the Species of *Meligethes* occurring on Rape.]—*Z. PflBau* **4** pt. 4 pp. 154–176, 9 figs., 29 refs. Munich, 1953.

This paper is based on official collections of adults of *Meligethes* spp. in fields of rape and turnip rape in seven localities in Bavaria in 1948–50 and collections and observations by the author in two fields of winter rape near Munich in 1950. Of all the adults collected in the three years, *Meligethes aeneus* (F.) accounted for 81·7, 92·7 and 94·2 per cent., respectively, *M. viridescens* (F.) for 4·6, 5 and 3·6 per cent., *M. coeruleovirens* Först. for 4, 1·3 and 0·8 per cent. and *M. coracinus* Sturm for 8·3, 1 and 1·4 per cent. In each year, the proportion of *M. aeneus* in the north of Bavaria exceeded that in the south, and only *M. aeneus* and *M. viridescens* were found each year in all the localities concerned [*cf. R.A.E.*, A **42** 353]. *M. aeneus* was always the first to appear, followed by the other species in the order listed. In one of the fields studied by the author, the first overwintered adults, all of *M. aeneus*, were taken on 29th March, when the midday temperature was 15°C. [59°F.], and on 21st April, when the temperature again reached this level, *M. aeneus* was present in large numbers. *M. viridescens* appeared at the end of April, when the rape blossom began to open, followed shortly afterwards by *M. coeruleovirens* and on 19th May by *M. coracinus*. The population reached its maximum on 8th May and fell to a minimum on 30th May, after which it rose again owing to the emergence of the new generation. Results in the other field were similar.

Müller considered that the overwintered females of *M. aeneus* feed on the nectar of spring flowers until their eggs are mature [**31** 36], but the author observed them feeding almost exclusively on rape, at first attacking the buds and frequently destroying all those on the main shoot, and then migrating to the blossoms, in which they fed mainly on the pollen but also on the styles and ovaries. When the rape blossom began to fall, the beetles migrated to other plants in flower.

Pairing of *M. aeneus* and *M. viridescens* occurred from 7th April until the end of May and mid-June, respectively. Eggs were generally laid in buds 2–3 mm. long, beside the anthers or occasionally between the sepals and petals, and the number of eggs per bud was usually 2–3. When six pairs of *M. aeneus* were caged at the beginning of April, the last eggs were laid on 2nd July, the average number per female being 246. The egg stage lasted 7, 5 and 4 days at 16, 18 and 21°C. [60·8, 64·4 and 69·8°F.], respectively, and the larval stage 27–30 days at 16°C. During the first of their two instars, the larvae remained in the buds in which they hatched, feeding mainly on the pollen but attacking the other parts if five or more larvae were present in one bud. After moulting, they migrated to other buds, and when full-fed, they dropped to the ground and pupated in cells about 1 in. below the surface of the soil. The prepupal stage lasted 1–4 days. To determine the duration of the pupal stage, 50 full-fed larvae of *M. aeneus* were placed in containers half filled with earth on 17th May, and adults emerged 14–18 days later. Adults of the new generation were observed in the field from the end of May. They attacked the remaining rape blossoms and the tips of the pods, but damage to the latter was slight. By 20th June, nearly all the beetles left the plants. In field-cage experiments with 12 lots of 100 newly emerged adults of *M. aeneus*, the first beetles burrowed into the soil in mid-July and the last in September, no pairing or oviposition being observed, and it is therefore concluded that there is only one generation in the year. Examination of the ovaries of

127 females that had emerged in June and had been caged separately showed that all were still immature in September.

Detailed descriptions are given of the egg, larva and pupa of *M. aeneus* and *M. viridescens* and of the adults of all four species together with notes on external morphological characters by which the two sexes can be distinguished.

GRISON (P.). **Régression brusque de *Lymantria dispar* L. par l'action prédatrice de *Calosoma sycophanta* L. dans les suberaies corses.**—*Rev. Zool. agric.* **54** no. 4–6 pp. 51–56, 4 figs., 9 refs. Talence, 1955.

Lymantria dispar (L.) is an important pest of cork oak [*Quercus suber*] in Corsica, and an outbreak in the south-east of the island in 1952–54 resulted in almost complete defoliation of the trees. Control measures were applied, but the outbreak was brought to an end in 1954 by *Calosoma sycophanta* (L.), which was unusually numerous and destroyed very large numbers of the larvae between 25th May and 10th June. It was not known whether factors other than the abundance of *Lymantria* in the previous two years had favoured the increase in this Carabid.

GAUMONT (R.). **Les phénomènes de la diapause chez la cheimatobie (*Operophtera brumata* L., Lépid. Geometridae).**—*Rev. Zool. agric.* **54** no. 4–6 pp. 57–61, 1 graph, 21 refs. Talence, 1955.

The author briefly reviews the life-cycle of *Operophtera brumata* (L.) on fruit trees near Paris and records investigations there showing that diapause in the egg stage is not obligatory. Eggs transferred immediately after being deposited to constant temperatures between 8 and 20°C. [46·4 and 68°F.] developed continuously, the optimum being about 15–16°C. [59–60·8°F.]. There was also no interruption in development at 2°C. [35·6°F.], though the eggs did not hatch. Development was more rapid at the beginning and end of the egg stage, and it was further found in experiments carried out at 16°C. that the eggs were more susceptible to DNC during these periods. From a comparison of the results with those recorded from Leningrad [*R.A.E.*, A **41** 167], where diapause in the egg stage is obligatory, it is concluded that two distinct types of development occur in this insect, with an intermediate type in which a period of diapause is obligatory but can be shortened by exposure to increased temperatures [*cf.* **5** 270; **43** 163].

ROEHRICH (R.) & RAMADIER (P.). **La lutte chimique contre le carpocapse des prunes (*Laspeyresia funebrana* Tr.).**—*Rev. Zool. agric.* **54** no. 4–6 pp. 65–68, 2 refs. Talence, 1955.

Investigations on *Cydia* (*Laspeyresia*) *funebrana* (Treitschke) on plum in south-western France in 1954 indicated that oviposition began towards the end of April. Pupae were observed from 14th June, adult emergence began on 1st July, most of the eggs had been laid by 12th July, and hatching began on 15th July. Treatments were applied on 14th July, in two orchards in which there were 2·8 and 3 eggs per 100 fruits, respectively, on 11th July, and in the first of which there were 5 per 100 on 12th July. The percentages of fruits infested at picking on 20th August and (in brackets) the percentages of fallen fruits collected between 30th July and 20th August that were infested in the two orchards, respectively, as compared with 15·3 (28·8) and 22·2 (15·3) for no treatment, averaged 3·3 (5·3) and 4·5 (3·2)

for an emulsion spray containing 0·0225 per cent. parathion, 8·8 (9·9) and 10 (8·8) for an emulsion spray containing 0·1 per cent. DDT, and 9 (19) and 13·4 (9) for a nicotine-sulphate spray containing 0·3 per cent. actual nicotine. In the first orchard, the corresponding figures were 5·1 (9·1) for 0·02 per cent. Diazinon [O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl thiophosphate] and white oil, and in the second they were 7·9 (5·1) for 0·03 per cent. wettable parathion.

Barbotin (F.). **Nouveaux essais de lutte contre la mouche de la carotte.**—*Phytoma* **7** no. 67 pp. 13–14, 2 figs. Paris, 1955.

Further experiments on the control of *Psila rosae* (F.) attacking carrots in Normandy [*cf. R.A.E.*, A **43** 28] were carried out in 1954. The seed was coated before sowing with a powder containing 65 per cent. lindane [almost pure γ BHC] at the rate of 39 parts toxicant per 1,000 parts seed (by weight), and protection from attack was compared with that given by the incorporation of insecticides into the soil before sowing. In the first test, the percentages of roots infested were 1·33 for the treated seed, 1 and 1·66 for soil treatment with about 1·8 and 0·9 lb. dieldrin and γ BHC, respectively, per acre and 13·6 for no treatment. In the second test, the corresponding percentages were 0 for treated seed, 1 for soil treatment with γ BHC at 0·675 lb. per acre, and 8·33 for no treatment, but these figures did not show the full effect of the treatments, since to obtain 300 sample roots it was necessary to pick from about 18½, 22½ and 44 ft. of row in the three groups, respectively, attack in spring having destroyed large numbers of the plants where no treatment had been applied. In the third test, the percentages of roots attacked were 3·5 for treated seed, 0·75 for soil treatment with aldrin at 2·7 lb. per acre and 20 for no treatment, and in the fourth, seed treatment reduced the percentage of attack from 9·66 to 1·33. Though seed treatment gave excellent results, it is pointed out that attack was severe only in April–July (50–100 per cent. of the plants being destroyed by July in some areas) so that it is not known whether the insecticide remains effective throughout the summer.

Bouron (H.), Perrot (A.), Bessard (A.) & Mimaud (J.). **Essai de traitement en 1954 sur tétranyques des arbres fruitiers.**—*Phytoma* 7 no. 67 pp. 15–17, 2 graphs. Paris, 1955.

An experiment on the control of *Metatetranychus ulmi* (Koch) was carried out in 1954 in an apple orchard near Paris. Hatching of the winter eggs began about 19th April, and sprays were applied on 7th May (at the beginning of petal-fall), when the first adults were present but had not yet oviposited. All spray quantities are given per 100 gals. Counts of the mites made on 27th April, 13th May and 21st June by the imprint method [*R.A.E.*, A **30** 134] showed that the numbers per 80 leaves on the three dates, respectively, as compared with 4,050, 2,164 and 5,394 for no treatment, were 2,108, 36 and 3 for 0·25 lb. demeton [diethyl 2-(ethylmercapto)-ethyl thiophosphate] from a 50 per cent. commercial preparation, 2,775, 59 and 4 for 0·25 lb. demeton from a 10 per cent. preparation, 2,042, 581 and 10 for 0·3 lb. parathion, 2,801, 415 and 12 for 0·24 lb. EPN [ethyl p-nitrophenyl thionobenzenephosphonate] and 2,971, 566 and 26 for 0·2 lb. Diazinon [O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl thiophosphate]. The necessity for spraying after almost all the winter eggs have hatched, but before the resulting adults have oviposited is stressed, and the difficulties

of determining this date are briefly discussed. Accurate timing is less important if a systemic acaricide, such as demeton, is used.

Pesson (P.), Toumanoff (C.) & Hararas (C.). **Étude des épizooties bactériennes observées dans les élevages d'insectes xylophages** (*Rhyncolus porcatus* **Germain,** *Scolytus scolytus* **Fabricius,** *Scolytus* (*Scolytochelus*) *multistriatus* **Marsham**).—*Ann. Epiphyt.* **6** no. 3 pp. 315–328, 7 figs., 11 refs. Paris, 1955.

Descriptions are given of three strains of bacteria that were isolated from the larvae of wood-eating insects during rearing experiments in the laboratory in France. All caused fatal infections. The first, *Paracolobactrum rhyncoli*, sp.n., was isolated from the body fluid and digestive tract of *Eremotes* (*Rhyncolus*) *porcatus* (Germ.), a weevil that infests pines, and healthy larvae became infected with it when they were reared on sawdust contaminated with a culture. *Acrobacter scolyti* and *Escherichia klebsiellaeformis*, spp.n., were found together in the body fluid of *Scolytus multistriatus* (Marsham), which infests elm. *S. scolytus* (F.) was experimentally infected with all three. At 32–35°C. [89·6–95°F.], symptoms appeared 12 hours after the larvae were placed on the infected medium and all died within 72 hours. At 15°C. [59°F.], infected larvae survived for up to 216 hours.

Bonnemaison (L.). **Diverses méthodes de protection des cultures contre les taupins.**—*Ann. Epiphyt.* **6** no. 3 pp. 329–405, 15 figs., 9½ pp. refs. Paris, 1955.

In 1940–45, there was a considerable increase in the damage caused by wireworms to cereal crops and beet in northern and eastern France, including the Paris region, and to cereals and potatoes in Brittany. The species chiefly responsible was *Agriotes obscurus* (L.), but *A. lineatus* (L.) is common near Paris and in the west, and *A. sputator* (L.) occurs in these districts and in the north. The author reviews the bionomics and control of these Elaterids, largely from the literature, showing that the life-cycle lasts four years, that the adults overwinter in the soil, usually in the pupal cells, and oviposit in late spring and summer, chiefly in grassland or in soil under lucerne or cereals, and that the larvae are injurious from late February to mid-May and again from September to the onset of cold weather, the injury caused being related more to the crop grown in the previous year than to the actual size of the larval population, and gives a detailed account of experiments begun in 1946 near Paris and in Brittany on chemical control, the results of which are compared with those recorded by other workers.

In tests of soil treatment, insecticides applied at high rates in sprays from a sprinkler between rows of young spring oats, or dusts broadcast along the plants and hoed in, did not penetrate deeply enough to control the larvae, but better results were obtained on spring wheat and oats when the soil was treated 2–3 weeks before sowing with D-D mixture (dichloropropane dichloropropylene) or carbon bisulphide injected to depths of 6 ins., with sprays of BHC, DDT or parathion, or with dusts of BHC, parathion or calcium cyanide, broadcast by hand and incorporated into the soil by double harrowing, carbon bisulphide and calcium cyanide proving inferior to the other treatments. Similar treatments were applied in fields to be planted with potatoes or sown with beet, and good protection was given by dusts

affording about 9 lb. BHC per acre. Better distribution was obtained when the insecticides were applied after ploughing and incorporated into the soil by cross-harrowing than when they were applied before ploughing. Treatment at the time of planting or sowing was less effective.

In tests of seed treatments, beet was well protected in almost all tests in which insecticides alone or with fungicides were applied to the seedballs or segmented seeds, or in which segmented seed, previously coated by two commercial processes, which are described, was used. The percentage increases in yield ranged up to 34, 19 and 31 for the three types of seed, respectively, and the best results were invariably given by dusts containing 40–60 per cent. γ BHC. Further tests indicated that dusting the seedballs is preferable to immersing them in liquid insecticides and that dusts containing 5–10 per cent. parathion or 40–50 per cent. γ BHC can be used with an organic mercury fungicide without affecting germination. For segmented seed, the maximum concentrations recommended for the dusts are 7·5–10 per cent. parathion and 40–50 per cent. γ BHC, and the optimum rate of application is 7–8 parts per 1,000 by weight. Similar treatment of wheat and oats with a mixture containing 20 per cent. γ BHC and an organic mercury compound gave yield increases up to 39 per cent., and it is concluded from germination tests that the best concentrations for seed treatment of cereals are 25–30 per cent. γ BHC for wheat, barley and oats, 30–40 per cent. γ BHC for maize, and 10 per cent. parathion for all four, the rates of application being 2 parts per 1,000 for wheat and barley, 3 per 1,000 for oats and 3–4 per 1,000 for maize.

Laboratory experiments showed that dusts and sprays of BHC, DDT or parathion are very effective against the adults of *Agriotes* spp. When an infested lucerne field was mown on 20th May, the crop removed two days later and a dust of 8 per cent. BHC applied at 13·5 lb. per acre before 28th May, when oviposition began, the numbers of adults and subsequently of larvae were considerably reduced, and better results were obtained by this method than by placing bundles of cut lucerne or grass sprinkled with DDT, BHC or parathion in the fields after mowing, to trap the beetles. It is pointed out that such treatment against the adults involves cutting the lucerne 10–15 days before flowering and the prompt removal of the crop from the field, and that it is effective only over fairly large areas, in which movement of the wireworms from untreated soil is not a problem.

Schvester (D.), Milaire (H.) & Gireau (R.). **Essais de traitements d'hiver sur pêcher contre la cochenille du mûrier:** *Pseudaulacaspis pentagona* **Targ.**—*Ann. Epiphyt.* **6** no. 3 pp. 407–419, 8 refs. Paris, 1955.

An account is given of experiments already noticed in which winter sprays were compared for the control of *Pseudaulacaspis pentagona* (Targ.) on peach near Lyons [*cf. R.A.E.*, A **44** 38, etc.], together with information on the phytotoxic effects of the materials applied. The soluble-oil product containing 90 per cent. mineral oil and 5 per cent. DNC used at 3 per cent. destroyed 90–100 per cent. of the flower buds, and a similar product containing 95 per cent. oil and 3·3 per cent. DNC was only slightly less injurious. The mixtures of the mayonnaise type were considerably less phytotoxic than the soluble-oil sprays when used at less than 4 per cent. The degree of injury caused was variable, and it is not known whether the oil or the DNC was the chief factor responsible, but it appears that winter sprays applied to peach should not contain more than 2·5 per cent. oil or 0·2 per cent. DNC.

Alfaro Moreno (A.). **Investigaciones sobre la biologia de *Cydia pomonella* L. en las condiciones de las vegas aragonesas y ensayos de tratamiento en ella basados.** [Investigations on the Bionomics of *C. pomonella* in the Plains of Aragon and Control Experiments based on them.]— *Monogr. Minist. Agric. Dir. gen. Coord.* no. 5, 98 pp., 8 pls., 12 graphs, 2 fldg. tables, 56 refs. Madrid, 1954. Price 25 *pesetas*.

Investigations on the bionomics and control of *Cydia pomonella* (L.) were carried out, mainly on apple, in the field and laboratory near Saragossa [*cf. R.A.E.*, A **44** 82] in 1950–52 in view of the serious losses caused. Adults of the overwintered generation emerged in outdoor cages between 5th May and 14th July in 1951, the maximum numbers appearing on 6th June, and between 5th May and 25th June in 1952, with a peak on 28th May. Eggs were laid between 21st May and 7th July in 1951 and between 12th May and 20th June in 1952, and it appeared that a minimum dusk temperature for several days of more than 15·5°C. [59·9°F.] was necessary for pairing and oviposition. In the field, only 3–5 per cent. of the larvae entered the fruits at the calyx, though in the laboratory, the percentage was about 25. Hatching began on 7th June in 1951 and 26th May in 1952, and first-generation adults emerged between 13th July and 21st August and 23rd June and 4th August in the two years, respectively. In rearing experiments in 1951 and (in brackets) 1952, development lasted 5–11 (5–9), 11–32 (10–26) and 9–24 (11–29) days for the egg, larval and combined prepupal and pupal stages, respectively, and the preoviposition period lasted 1–16 (1–12) days, though some of the first-generation larvae overwintered.

Eggs of the second generation were laid between 19th July and 20th August in 1951 and 24th June and 7th August in 1952, and the egg stage lasted 5–9 and 4–7 days, respectively. Larvae were present from 26th July and 30th June in the two years, and spun their cocoons after 18–43 and 14–33 days, respectively. The second-generation larvae all hibernated in 1950 and 1951, but a small proportion completed their development without overwintering in 1952, the pupal stage lasting 14–25 days and adults emerging between 31st July and 22nd September. Eggs of the third generation were laid on 2nd–9th September, and the larvae that hatched from them spun cocoons after 24–33 days and overwintered.

Adult emergence was also studied by the use of trap jars containing an 8 per cent. solution of molasses renewed weekly. The numbers taken are shown on graphs, and related to temperature. Adults were taken between 10th May and 12th September in 1950, between 21st May and 10th September in 1951, and between 7th May and 17th September in 1952, and the numbers were greatest in pots hung in the upper parts of the trees. Corrugated cardboard bands were placed round the trunks and large branches of apple and pear trees from June–July to September–October, and the numbers of larvae taken in them are shown in tables and discussed in relation to position on the tree. Bands treated with β-naphthol [*cf.* **30**.482] proved more attractive than untreated bands and gave complete kill of all the larvae that entered them. Observations on parasites in 1952 showed that the commonest were *Ichneumon* sp. and *Pristomerus vulnerator* (Panz.). Adults of the former emerged from the *Cydia* cocoons from late March until late May, and those of the latter from early May until mid-July.

Recommendations for the control of *C. pomonella* in Spain require spray applications to be begun at petal-fall, but as, on apple near Saragossa, this occurs 3–4 weeks before the eggs hatch, the effect of delaying treatment was tested. In 1951, spraying was begun on 11th June, when the catches of adults were beginning to increase and attack on the fruits had just begun. Treatments were applied against the first generation only, and the trees

had been sprayed with an arsenical on 22nd May against *Hyponomeuta padellus malinellus* Zell. The best results were given by four weekly applications of 0·6 per cent. lead arsenate and by six of 0·2 per cent. wettable DDT, which both reduced the total percentage of fruits infested from 57–79 to 33; 0·1 per cent. DDT applied 4–6 times reduced it to 46, and lindane [almost pure γ BHC] was ineffective. Infestation by Tetranychids became severe on trees sprayed with DDT.

In 1952, treatments were begun in two orchards on 28th May, when the first signs of attack were observed, and concluded on 6th August, the last application being directed against the second generation. In the first orchard, the percentages of fruits infested at picking on 27th August, and (in brackets) the percentages of the fallen fruits that were infested, were reduced from 53 (100) for no treatment to 27 (89) by 0·036 per cent. wettable γ BHC applied six times, 5 (33) by 0·6 per cent. lead arsenate applied five times, and 2 (49) by a mixture of 0·6 per cent. lead arsenate and 1 per cent. white oil, applied five times. In the second orchard, the percentages of fruits attacked at picking, on 3rd October, were 33 for five applications of 0·04 per cent. γ BHC, 17 for four applications of 1 per cent. white oil, and 11 for five applications of 0·6 per cent. lead arsenate. In a third orchard, treatments were applied on 3rd, 10th and 20th June against the first generation and on 31st July against the second, to trees that had been sprayed with an arsenical against *Hyponomeuta*. The apples were picked on 6th September, and the percentage attacked was reduced from 58 for no treatment to 46 and 23 by emulsified solutions of 0·05 and 0·1 per cent. DDT, respectively, 37 by 0·04 per cent. wettable γ BHC, 17 by 1 per cent. of a product containing 4 per cent. DDT and 1·5 per cent. γ BHC in white oil, 14 by 0·6 per cent. lead arsenate and 10 by this last with the addition of 1 per cent. white oil.

HORBER (E.). **Ökologische und statistische Untersuchungen an Populationen des Feldmaikäfers** (*Melolontha vulgaris* F.). **I.** [Ecological and statistical Investigations on Populations of *M. melolontha*. I.]—*Landw. Jb. Schweiz* **69** pt. 3 pp. 197–210, 8 figs., 7 refs. Berne, 1955. (With Summaries in French and English.)

As a sex ratio of 1:1 is considered in control operations in Switzerland to indicate the climax of emergence of the adults of *Melolontha melolontha* (L.) (*vulgaris* F.) from the soil [*cf. R.A.E.*, A **40** 188], sample diggings in meadows were made in March and April in 1952–54 to determine whether the two sexes were in fact equal in numbers just before emergence from the soil. Over 6,000 beetles were collected, and details are given of the secondary characteristics by which the sexes could usually be distinguished. Statistical analysis of the results indicated that the ratio was almost 1:1, and as the results had been based on the classification of less than 90 beetles in 12 of 13 meadows in which a significant deviation was observed and of 109 in only one, and only one significant deviation was found in 12 meadows in which over 90 beetles were examined, it is recommended that forecasts should be based on the classification of not less than 90 individuals or on the number found in not less than 100 sample diggings 2·65 sq. ft. in area.

Since the newly emerged males reach forest edges before the females, it was thought that they might also migrate upwards in the soil sooner. Sample diggings between 2nd and 9th April, 21st and 24th April, 28th and 30th April, and 4th and 5th May 1953 showed that the numbers of males and (in brackets) females per soil sample were 9 (2), 46 (20), 24 (28) and 6 (14), respectively, in the upper 2 ins. of soil, and 70 (77), 14 (54), 4 (12) and 0 (4) in the next 6 ins. The first males in flight were observed on

18th April, and the first females on 21st April, with maxima between 21st and 29th April, and 24th April and 5th May, respectively. Males ascended to the surface when the average daily temperatures reached 8–12°C. [46·4–53·6°F.], whereas the females did not do so until the daily mean had exceeded 12°C. for some days, and beetles that had ascended returned to the subsoil when temperatures fell at the middle and end of April. The addition, in each of the three years, of all average daily temperatures above 8°C. from 1st March until the first beetles emerged from the soil gave an annual average of 256·3°C. [461·34°F.], and it is suggested that the prediction of flights should be based on this figure.

Wallace (H. R.). **Notes on the Biology of** *Arhopalus ferus* **Mulsant (Coleoptera: Cerambycidae).**—*Proc. R. ent. Soc. Lond.* (A) **29** pt. 7–9 pp. 99–113, 5 graphs, 15 refs. London, 1954.

Stumps of Corsican pine [*Pinus nigra laricio*] and Scots pine [*P. sylvestris*] left standing near Liverpool after felling operations during 1939–45 became heavily infested by *Arhopalus* (*Criocephalus*) *ferus* (Muls.) [*cf. R.A.E.*, A **32** 184]. Studies were made during 1950–52 on the bionomics of this Cerambycid, the development of which requires at least two years and may be extended to five or more, and a detailed account is given of the results. Pine stumps appeared to be the preferred habitat, but unhealthy trees were sometimes attacked and timber of some commercial value destroyed.

Benson (R. B.). **A new British** *Nematus* **(Hym., Tenthredinidae) attacking Black-currant.**—*Ent. mon. Mag.* **89** pp. 60–63, 13 figs., 4 refs. London, 1953.

Nematus olfaciens, sp. n., is described from adults of both sexes reared from larvae found infesting black currant in Britain in 1952 and recorded from the same plant in Finland. Characters are given distinguishing its various stages from those of related species.

Gough (H. C.) & Woods (A.). **Seed Dressings for the Control of Wheat Bulb Fly.**—*Nature* **174** no. 4442 pp. 1151–1153, 1 fig., 8 refs. London, 1954.

Seed dressings have mostly proved unsatisfactory against *Hylemyia* (*Leptohylemyia*) *coarctata* (Fall.) on wheat in Britain, and since this was thought to be due to the length of time elapsing between sowing and the hatching of the larvae, this factor was investigated in eastern England in 1953–54. The dressings tested comprised 40 per cent. γ BHC or dieldrin with the addition of 0·8 and 0·6 per cent., respectively, of an organic mercury fungicide, both applied to the seed at 3 oz. per bushel, and a proprietary fungicide containing 1 per cent. organic mercury compound, which was applied at 2 oz. per bushel. The seed was sown early (October or November) and late (December or January) in two fields, one on peat soil and the other on acid peat, both of which contained populations of 3–5 million eggs of *H. coarctata* per acre and had previously been under potatoes. By April, the early-sown wheat in both fields had tillered sufficiently to mask the effect of the heavy larval attack; it had developed well on the peat soil by May, but had been considerably thinned as a result of infestation on the acid peat. The late wheat was sown on 6th January on the peat soil, and by April the stand from seed treated with BHC was

uniformly good, that from seed treated with dieldrin was less satisfactory, and that in the control plots was uniformly poor; a month later, the plants from seed treated with dieldrin showed a marked improvement, whereas those in the control plots had failed. On the acid peat, the late sowing was on 17th December, and the plants in all the plots had failed by May, though BHC had given moderate control in April and dieldrin some control in two of the three plots treated with it.

Counts of attacked shoots and larvae were made at the end of March on plants from unit areas in each plot. When the data were examined statistically, it was found that the insecticides had little or no effect on early-sown wheat, but produced marked and significant reductions on late-sown wheat on peat soil; the differences between treatments shown by late-sown wheat on acid peat were not significant, probably because of the slightly earlier sowing date. In a previous trial, dead larvae were rather more numerous in plants grown from seed treated with aldrin or dieldrin than in plants from seed treated with BHC or left untreated. Detailed comparisons of mortality were not made in the present work, but when the percentages of apparently normal larvae from the late-sown plants were considered in relation to the time elapsing between collection and examination of the samples, it was found that they were uniformly low for dieldrin but variable for BHC. It appeared that dieldrin killed the larvae after they had entered the plant, though its action was delayed and may therefore have been systemic. Many plants from the BHC plot bore evidence that larvae had attempted unsuccessfully to enter them, and it is concluded that the main effect of this material is to prevent entry.

Rainey (R. C.). **Observation of Desert Locust Swarms by Radar.**—*Nature* **175** no. 4445 p. 77, 7 refs. London, 1955.

A flying swarm of *Schistocerca gregaria* (Forsk.) was detected for the first time by radar in March 1954, from a ship in the north of the Persian Gulf. The locusts appeared to constitute a swarm with a radius of at least 15 miles and were detected at ranges of up to 60 miles, over a sector of up to 80°, giving large echoes on a plan-position-indicator similar to the effects of mechanical jamming. Flying locusts were seen at the time in the light of a signalling projector, and dead ones were seen floating on the sea the next morning. The sighting was made two hours after sunset and 45 minutes before moonrise, and thus provides evidence of a swarm flying in darkness and over the sea, when visual reactions were likely to be at a minimum, and its cohesion was probably maintained by auditory reactions. The air temperature on the ship was 69°F., which is lower than has previously been recorded during night flights by *S. gregaria* on such a scale, but most of the locusts were flying at higher levels, where the temperature was probably higher, temperature inversions being usual over the Persian Gulf in March.

Robertson (I. A. D.). **The Numbers of Eggs in Pods of the Red Locust, *Nomadacris septemfasciata* (Serville) (Orth., Acrididae).**—*Ent. mon. Mag.* **90** pp. 254–255, 8 refs. London, 1954.

The following is virtually the author's summary. Early data on the number of eggs in a pod laid by *Nomadacris septemfasciata* (Serv.) during a plague indicate an average of about 60, with a range of 20–100. Recent data from the Rukwa Valley outbreak area in southern Tanganyika show a wider range of 20–195 eggs per pod, with averages from about 50 to 120,

the general average being 92. Such differences may be of great importance in relation to the sizes of resulting populations. In a favourable year, the population could increase a hundredfold.

CHAPMAN (R. F.). **Roosting Behaviour in some African Grasshoppers.**—*Ent. mon. Mag.* **91** pp. 76–81, 4 figs., 6 refs. London, 1955.

The following is almost entirely the author's summary. Numerical data on the tree-roosting habit of Acridids were obtained in the field for the first time when observations were made on the grasshoppers, *Catantops saucius* (Burm.) and *C. melanostictus* Schaum, in the Rukwa Valley, in southern Tanganyika. The data support the conclusions reached from a laboratory study of roosting in a locust [*R.A.E.*, A **44** 152]. Both vacation and occupation of the roosts involved much movement into and out of the trees, the changes in distribution depending on whether the number of grasshoppers going up or down preponderated. Vacation was dependent on an increase in temperature resulting in an increase in activity and hence in a descent. This occurred only above a certain critical temperature of about 21°C. [69·8°F.]. Below this, temperature changes were not effective in producing descents. Vacation was not complete until ground temperature exceeded air temperature, so that no further re-ascents occurred. The upward movements, leading to occupation of the roosts, were either by crawling or by flying. Movement towards the trees was visually directed. Spontaneous flights increased when temperature fell, sharp falls being particularly effective in increasing activity. Movement on and from the trees was seen to continue as long as there was sufficient light for observation. There is no evidence that humidity played any part in either the occupation or the vacation of the roosts.

COCKBILL (G. F.). **Investigations on the Control of Insect Pests of stored Grains and Pulses.**—*Rhod. agric. J.* **50** no. 4 pp. 294–323, 11 graphs, 3 refs. Salisbury, S. Rhod., 1953.

Calandra oryzae (L.) is the most important pest of stored maize in Southern Rhodesia, and the damage caused by it is extended by *Tribolium* spp. Sprays of wettable DDT are commonly applied to the upper surfaces of the outermost bags of maize during stacking and periodically thereafter to the exposed faces of the tightly packed stacks for insect control, and experiments were carried out in 1952–53 to compare the effects of this treatment and of similar applications of dusts of 2·5 per cent. DDT or 5 per cent. BHC (0·65 per cent. γ isomer). The insecticides were applied to the floors on which the stacks were to be built, the upper and outer surfaces of the outside bags and the upper surfaces of the completed stacks at rates such that the cost of the three treatments was the same; these were 1 oz. per 3 sq. yards for the BHC dust, 1·055 oz. for the DDT dust and 0·161 oz. for 50 per cent. wettable DDT powder (in about 0·36 pint water). The stacks remained untouched from 27th November 1952 to 23rd April 1953, when examination of the numbers of damaged grains in samples and changes in net weight, after elimination of moisture differences, showed that all treatments caused significant reductions in insect damage. They also caused significant increases in the numbers of dead examples of *C. oryzae* and *Tribolium* spp., of which about 80 per cent. were *T. castaneum* (Hbst.) and the rest *T. confusum* Duv., on sample areas on the outside of the stacks; *Calandra* apparently congregated on the outside of the lower bags

and *Tribolium* on the upper bags, regardless of treatment. Counts of both damaged grains and dead insects on treated surfaces showed that wettable DDT gave better protection and was effective for a longer period than the other treatments, reducing the loss of weight in outside bags by 5·1 per cent., as compared with the untreated stack. Inside bags did not appear to benefit from the application of insecticide to the outside bags, and they received more protection from their position within the stack than did the outer ones from insecticidal treatment. Treatment of all bags would therefore be unlikely to improve control in a tightly packed stack, but might do so in average farm piles.

As sorghum (Kaffir corn) stored in bags is also subject to insect damage, the same treatments were tested for its control in 1953. The treated stacks remained in position from 26th January until 10th June, when examination showed that *C. oryzae* was the most abundant pest, *Laemophloeus* sp. more abundant than *Tribolium* spp. and *Oryzaephilus surinamensis* (L.) rare. Infestation was light, no relation was found between treatment and number of dead insects, and the treated stacks showed no significant reductions in loss of weight or numbers of damaged grains.

Bruchids are important pests of stored beans in Southern Rhodesia, and the BHC dust was tested for their control by applying it at the rate of 1 oz. per 3 sq. yards to the upper surface and outside edges of each layer of bags as the stack was built. The stack remained intact from 23rd December 1952 to 27th May 1953, when it was found that treatment had reduced the loss in net weight of beans, which was mainly due to insect damage, from 13·3 to 3·5 per cent., increased the mean numbers of dead Bruchids in outside bags from 18·3 to 47, with no effect on those in the inner bags, and reduced the percentage increase in number of beans damaged from 30 to 12. No unpleasant odour or flavour was detected in treated beans.

Hepburn (G. A.) & Bishop (H. J.). **The Insect Pests of *Citrus* in South Africa.**—*Bull. Dep. Agric. S. Afr.* no. 333, [4+] 31 pp., 1 col. pl., 2 figs., 18 refs. Pretoria, 1954.

Notes are given on the bionomics, economic importance, local distribution, natural enemies and control of the major pests of *Citrus* in South Africa, the species concerned being the Coccids, *Aonidiella aurantii* (Mask.), *Lepidosaphes beckii* (Newm.) (*pinnaeformis*, auct.), *Coccus hesperidum* L., and *Planococcus* (*Pseudococcus*) *citri* (Risso); the ants, *Anoplolepis custodiens* (F. Sm.), *Pheidole megacephala* (F.), and *Iridomyrmex humilis* (Mayr), which foster the last two of these; the Trypetids, *Ceratitis capitata* (Wied.) and *C.* (*Pterandrus*) *rosa* Karsch; *Argyroploce leucotreta* Meyr., *Papilio demodocus* Esp., *P. nireus* var. *lyaeus* Dbd., *P. dardanus* var. *cenea* Stoll and *Heliothis armigera* (Hb.); *Aphis citricidus* (Kirk.) (*tavaresi* Del G.); the Psyllid, *Trioza* (*Spanioza*) *erytreae* Del G.; and *Scirtothrips aurantii* Faure. Parathion has been tested against most of them, usually in wettable-powder sprays, and the precautions to be adopted in its use are discussed in an appendix. At 0·75 lb. per 100 gals. water, parathion gave good commercial control of *Aonidiella aurantii*; in eastern districts, early applications were the most effective, and better results were obtained on old trees than on young ones, which appear to need two applications. In trials at several places, 95–98 per cent. of the fruits were free from *L. beckii* after applications of 2 or 4 lb. 15 per cent. wettable parathion per 100 gals., and a concentration of 3 lb. applied at a pressure of 400 lb. per sq. in. is recommended. The immature Coccids sometimes survived for four weeks or more after treatment, but did not grow and eventually died; such individuals probably

hatched from eggs that escaped the fumigant action of the parathion and their slow death probably resulted from ingesting sublethal doses from the rind. Surface residues of parathion lose their toxicity in 8–10 days, but the rind of oranges sprayed 69 days earlier with 1·5 lb. 15 per cent. wettable parathion per 100 gals. was found to retain 0·8 part per million by weight. *Planococcus citri* was effectively controlled by 2 lb., *Aphis citricidus* and *Trioza erytreae* by 1 lb. and *Scirtothrips aurantii* by 4 lb. of the wettable powder per 100 gals. Growers obtained good control of ants by applying a dust of 2 per cent. parathion in and round their entry holes or inserting a parathion suspension into the holes. Against Trypetids, a bait-spray containing 1 oz. of the parathion powder and 3 lb. sugar in 4 gals. water applied at a rate of at least 4 fl. oz. per tree every seven days and renewed after rain is recommended; sodium fluosilicate at 2 oz. should be substituted for parathion during the three weeks prior to harvest. In tests against *Argyroploce leucotreta*, four applications of the powder at 1·5 lb. per 100 gals. in December–March gave no significant reduction in infestation in 1950–51, where populations were low, but in 1952, when infestation was higher, a single application at 5 lb. on 12th March and two at 2½ lb. on 12th and 27th March gave significant control. Parathion is less satisfactory against *H. armigera*, which damages the young fruits, than a spray of 2 lb. 50 per cent. wettable DDT per 100 gals. or a dust of 5 per cent. DDT; a dust of 10 per cent. toxaphene is also effective. *Papilio* spp. are of importance only on nursery stock or young trees, and as the latter are frequently damaged by hand collection of the eggs and larvae, the use of parathion sprays is suggested.

Parathion is considered preferable to DDT for use on *Citrus* because its residues are less persistent and in consequence less injurious to parasites and predators. It sometimes results in an increase in infestation by *Coccus hesperidum*, however, possibly owing to destruction of its parasites, and it is suggested that where this Coccid is present, applications against other pests should be made early in the season and sections comprising about ten rows of trees treated at successive intervals of 4–6 weeks.

VIEIRA (R. M. S.). **A mosca da fruta** (*Ceratitis capitata* (**Wied.**)) **na Ilha da Madeira.** [*C. capitata* on the Island of Madeira.]—219 [+1] pp., 12 pls. (1 col.), 21 figs., 6 graphs, 5 maps, 62 refs. [Funchal] Grémio Export. Frutas Madeira, 1952. (With Summaries in English and French.)

Ceratitis capitata (Wied.) has long been injurious to fruits in Madeira, where it is found in almost all the coastal regions, extending up to about 2,300 ft. in the south and 1,300 ft. in the north; its exact distribution there is shown on a map. In the first part of this book, the classification of the fruit-fly is reviewed, a list is given of its numerous host fruits, with indications of those that are infested in Madeira, the injury to the principal fruits attacked is described, the effects of ecological factors on the development of the fly are discussed, all stages are described and its bionomics are reviewed, largely from the literature. During rearing in the laboratory throughout the year at field temperatures, with maximum and minimum monthly averages of 22·5 and 15·3°C. [72·5 and 59·54°F.], the egg, larval and pupal stages lasted 2–5, 10–19 and 11–27 days, respectively, with averages of 3·6, 14·8 and 18·2 days. Tables are given showing the duration of the larval stage in various fruits at different times of the year, and the average dimensions of the puparia obtained from them. In tests on the maximum depth from which adults can emerge, none reached the surface

when the puparia were buried about 3 ins. deep in compact soil or in loose soil that was moist or saturated, but some emerged from depths of about 13 ins. in loose, dry soil, though those that did so from more than about 8 ins. were injured. Females formed 44·1 per cent. of the adults reared in the laboratory. Oviposition began 5–16 days after emergence, and six females laid an average of 672 eggs each over a period of 108 days. The adults survived for 4·1–4·6 days when kept without food or water, 5·8–6·4 days when provided with water only and 68–78 days when provided daily with fruit juice and honey solution, and it is thought that they probably survive in the field for an average of about 60 days. In the laboratory, eight generations developed in the year.

In the second part of the book, control measures are discussed, largely from the literature. A spray of about 3 lb. 50 per cent. wettable DDT per 100 gals. gave good results on *Citrus* and pear in Madeira, resulting in 85–97 per cent. uninjured fruits on orange when applied every 15–18 days from late September to December. However, because of its numerous disadvantages, the widespread use of DDT is not advised, and emphasis is laid on the protection of fruits by paper bags, the picking of fruits while still unripe whenever possible, the destruction of infested fruits and the use of bait-traps. The only natural enemy of *C. capitata* in Madeira is *Pheidole megacephala* (F.), which destroys the larvae as they enter the soil to pupate, but this ant is being driven to the higher altitudes by the introduced *Iridomyrmex humilis* (Mayr). The literature on the parasites and predators of the fruit-fly elsewhere is reviewed and the possible introduction of selected species into Madeira is suggested.

Day (M. F.) & Irzykiewicz (H.). **On the Mechanism of Transmission of non-persistent phytopathogenic Viruses by Aphids.**— *Aust. J. biol. Sci.* **7** no. 3 pp. 251–273, 1 fig., 66 refs. Melbourne, 1954.

The authors present a modified working hypothesis to elucidate the mechanism of the transmission of non-persistent viruses by Aphids, discuss it with reference to the literature and give the results of experiments carried out in Australia to test some aspects of it. The hypothesis postulates that the stylets become contaminated with virus while probing infected tissues and that only this virus is of significance in disease transmission, ingested virus playing no part in the process. Some of the virus on the stylets becomes inactivated by salivary fluids; viruses differ in their susceptibility to this inhibition, and Aphid species vary in the production of the inhibitor. Fasting decreases the activity of the salivary inhibitors.

In experiments with *Myzus persicae* (Sulz.) and *Brevicoryne brassicae* (L.) transmitting cauliflower mosaic and *M. persicae* transmitting potato virus Y, transmission occurred within 2–3 minutes of the beginning of the acquisition feed [*cf. R.A.E.*, A **40** 187; **42** 143], and experiments with *M. persicae* already noticed [**42** 215] and observations on the feeding behaviour of this species further indicated that sufficient material to reach the midgut is unlikely to be ingested during the short feeding periods that enable the Aphid to become infective. Virus present on the stylets or in the anterior part of the foregut must therefore be responsible for transmission. Since the stylets are shed at each moult, any virus on them at such times must be lost, and, in experiments with *M. persicae* on turnip severely infected with cauliflower mosaic, Aphids that had just moulted were unable to infect healthy plants, though individuals not in the process of moulting did so. The inability of *M. persicae* to transmit when the stylets were artificially wetted with infective sap [**40** 187] has been regarded

as evidence that viruses are not carried on the outside of the stylets. In the present studies, this Aphid readily transmitted cucumber mosaic after feeding on an infected spinach leaf, but not after feeding through a plastic membrane on sap from a similar leaf, which may have contained an inhibitor, or a highly infective solution prepared by centrifuging infected leaves of *Nicotiana glutinosa*, from which it appears that the Aphid is unable to take up virus from solutions, so that the earlier assumption is invalid.

It has been suggested that the salivary sheath formed during feeding prevents *M. persicae* from ingesting the virus of tobacco mosaic [**33** 160], but when apterae of *M. persicae*, *B. brassicae* and *Macrosiphum solanifolii* (Ashm.) (*euphorbiae*, auct.) that had fed through a plastic membrane on a concentrated solution of this virus were macerated in a phosphate buffer, virus was separated from them by centrifuging and shown to be infective for *N. glutinosa*. The hypothesis suggests that Aphid saliva can prevent transmission [*cf.* **28** 301]. Trypsin inhibits all the mosaic viruses with which it has been tested, but no mechanism permitting the proteinase of an Aphid to come in contact with the virus has been suggested. The amount of saliva produced by Aphids is too small for direct study but saliva from *Periplaneta americana* (L.) and *Nezara viridula* (L.) was found to inhibit tobacco mosaic and potato virus Y. Tobacco mosaic appeared to be less readily inhibited than potato virus Y, and the saliva of *Periplaneta* to be more inhibiting than that of *Nezara*. Published data relating to the persistence of mosaic viruses in Aphid vectors are summarised in a table and indicate a probable complete range of variation from viruses that persist only for a few minutes to those that do so for many days. These viruses probably comprise a series decreasing in sensitivity to the salivary inhibitors. The limited data available indicate that persistence is greater *in vitro* and in fasting Aphids than in fed Aphids [**29** 27]; the viruses of celery yellow spot [**35** 171] and carrot motley dwarf [**37** 275] are the most persistent of those considered and are evidently unaffected by inhibitors. When examples of *Myzus persicae* that had fed for 20–120 seconds on plants infected with potato virus Y were transferred to healthy potato leaves, significantly more successful transmissions were obtained during the first feeds on the latter than in subsequent ones [*cf.* **26** 342; **35** 205]; the rapid loss of infection is in part due to the cleansing of the stylets during repeated feeding, but it is hastened by another factor, probably the inhibiting effect of the saliva. Successful transmissions of cucumber mosaic from infected spinach by fasting *M. persicae* were only one third as numerous when the acquisition feed lasted 10–20 minutes as when it lasted 20–120 seconds. This might be attributed to the inhibiting effect of a feeding product or to a higher concentration of the virus in the tissues tapped during short feeding periods, but the former is the more probable, since other tests with this Aphid showed that the duration of the acquisition feed did not affect transmission of cauliflower mosaic, which therefore appears to be relatively unaffected by the saliva.

Experiments on the effect of fasting in increasing the ability of a vector to transmit [*cf.* **26** 343], showed that it was not associated with a change in the production of digestive enzymes, the rate of penetration of the stylets, or the amount of food ingested. The stylets of Aphids removed from a plant on which they are feeding remain extruded from the labium, and feeding cannot be resumed until they have been ensheathed. Observations on large numbers of *M. persicae*, *B. brassicae* and *Macrosiphum solanifolii* showed that the stylets were still protruding 15 minutes after removal in 8 per cent. of each of the first two species and after 30 minutes in 1·5 per cent. of *Myzus persicae*; in *Macrosiphum*, ensheathment was very rapid. A fasting period of 30 minutes therefore enables the Aphids to

begin feeding immediately on coming to rest on a leaf. In tests with *Myzus persicae* transmitting cucumber mosaic, in which the duration of the acquisition and inoculation feeds was 1–2 and 15 minutes, respectively, 40 out of 94 attempted transmissions were successful when the Aphids had previously fasted for ½–1 hour and 27 out of 96 when they had not fasted and fed within five minutes of being placed on the infective plant; increasing the fasting period to 18 hours did not significantly increase the proportion of successful transmissions. If the inhibitor were contained in the saliva, it seemed possible that recorded slight increases in vector efficiency following prolonged fasting [**26** 342; **28** 301] might be due to changes in saliva production. No salivary sheaths could be demonstrated in plant tissues on which *M. persicae* and *B. brassicae* had fed for less than an hour, but when a liquid medium containing methylene blue was used, they were observed within a minute of the puncturing of the membrane, whether the Aphids had not fasted or had fasted for up to 24 hours. Aphids that had fasted for 48 hours fed before a salivary sheath was formed, however. No marked histological differences were detected in the salivary glands of *M. persicae* and *Macrosiphum solanifolii* that had fasted for up to 18 hours or that had fasted for 18 hours and subsequently fed for up to six hours.

Very few species of Aphids are unable to transmit non-persistent viruses, but those that do transmit differ markedly in efficiency. The relative efficiencies of various species in the transmission of six such viruses are summarised in a table, from which it appears that *Myzus persicae* is frequently one of the most efficient as well as one of the commonest vectors. An examination of its salivary sheaths in plant tissues showed them to be hair-like in *Datura*, carrot and tomato but much more conspicuous and damaging in potato; there were also well marked differences between the salivary sheaths of *M. persicae* and *Brevicoryne brassicae* in the same plant. A comparison of feeding behaviour showed that the pre-feeding acts of probing in swede by *Brevicoryne brassicae* lasted for considerably longer than those made by *M. persicae*, and that *Macrosiphum solanifolii*, which may remain in a feeding position for 30 minutes without puncturing the leaf when transferred from one plant to another, generally probes more often and more deeply than does *Myzus persicae*, but withdraws its stylets very much more readily. When the relative efficiency of these two Aphids as vectors of cucumber mosaic was studied, an attempt being made to eliminate the observed differences in behaviour by using only individuals that had fasted overnight, that obtained their acquisition feed within five minutes of being placed on the infective plant, and that fed on it for five minutes, successful transmissions by *M. persicae* were four times as numerous as those by *Macrosiphum*.

It is pointed out in a final discussion that the experimental results obtained tend to confirm the initial hypothesis, observations recorded in the literature that are in apparent conflict with it [**19** 272; **37** 261] are briefly discussed, and it is proposed that Aphid-borne viruses should be classified as " vector-direct " or " vector-latent." Vector-direct viruses are transmitted on the mouth-parts, are generally readily sap-transmissible, do not multiply in their vectors or pass through a long latent period within them, and are more efficiently transmitted by fasting insects; many become concentrated in the mesophyllic tissues of plants and cause mosaic diseases. Vector-latent viruses are transmitted by ingestion, passage through the gut into the haemocoele and reinjection with the saliva and mostly pass through a long latent period in the vector; many are specific to a relatively few vector species, they are generally not sap-transmissible, they may multiply in their vectors, transmission is not usually facilitated by fasting, and some are confined to the vascular tissues of the plants. A vector that normally

transmits by the second method may occasionally contaminate its mouth-parts with virus and transmit by the first, and habitual transmission by both methods is not impossible, though no example of it is known.

DAY (M. F.) & IRZYKIEWICZ (H.). **Physiological Studies on Thrips in Relation to Transmission of Tomato Spotted Wilt Virus.**—*Aust. J. biol. Sci.* 7 no. 3 pp. 274–281, 17 refs. Melbourne, 1954.

Thrips that are vectors of tomato spotted wilt cannot acquire the virus except by feeding on diseased plants as nymphs, though both nymphs and adults transmit it [*cf. R.A.E.*, A **19** 744; **20** 212; **21** 584], and the reason for this inability was investigated in tests with *Thrips tabaci* Lind. in the laboratory in Australia. Since the virus is known to be rapidly destroyed by oxidation and the tracheation of the midgut of insects was shown in a paper already noticed [**41** 23] to be correlated with the oxidation-reduction potential in the gut, comparisons were made of this potential and of the pH in the midgut of nymphs and adults of *T. tabaci* and the non-vector species, *T. imaginis* Bagn. Though the midgut of the adults was more completely tracheated than that of the nymphs, no differences in either value were found between stages or species, and conditions in the gut of the nymphs of *T. tabaci* appeared unsuitable for long survival of the virus. As the nymphs had been observed to damage plant tissues more than the adults, it was thought that they might ingest a greater amount of food, but when both stages of *T. tabaci* were fed on radioactive sucrose solution and on radioactive leaves, the mean amounts ingested per nymph and adult, respectively, per minute were $1{\cdot}2 \times 10^{-3}$ and 2×10^{-3} cu. mm. solution and $0{\cdot}6 \times 10^{-4}$ and 1×10^{-4} mg. leaf tissue. It has been suggested that the midgut of the adult may be less permeable than that of the nymph, but none of eight adults kept on infected tomato plants for 48 hours, in the middle of which their midguts were punctured with a needle, were able to infect healthy seedlings to which they were transferred and on which they survived for 14 days. An attempt to detect physiological differences in gut absorption between adults and nymphs was made by allowing both stages of *T. tabaci* and *T. imaginis* to feed through plastic membranes for 48 hours on solutions containing increased iron and copper salts. Subsequent histochemical tests showed that the metals were evenly distributed throughout the epithelium of the midgut in all the test insects and that no region appeared to be especially absorptive. Some difference may nevertheless exist in the permeability of the midgut of the two stages, and it is further possible that the virus may be unable to multiply in the tissues of the adult.

POWNING (R. F.). **A Study of Cysteine Desulphydrase in certain Insects.**—*Aust. J. biol. Sci.* 7 no. 3 pp. 308–318, 4 figs., 17 refs. Melbourne, 1954.

Investigations have shown that larvae of *Tineola bisselliella* (Humm.) convert heavy metals ingested in their food into insoluble sulphides, which they excrete [*cf. R.A.E.*, A **42** 139], and that cystine is present in their excreta [**42** 216]. The low oxidation-reduction potential in their midgut enables these insects to digest the keratin of wool [*cf.* **42** 140], and since the production of the reducing agent, hydrogen sulphide, from certain sulphur compounds by the action of enzymes (desulphydrases) has been observed in bacteria and mammalian tissues, the experiments here described were performed to discover whether a similar process occurs in *T. bisselliella* and other insects. Enzyme activity was assessed as the volume of hydrogen

sulphide produced by the action on *l*-cysteine of extracts prepared from fresh tissues, usually whole insects, that were ground with sand and distilled water and subsequently centrifuged and freed from fat. It was found that larvae of *T. bisselliella* contained a highly active cysteine desulphydrase concentrated in the gut. Cysteine desulphydrases were also present, though less active, in larvae of *Musca domestica* L., *Ephestia kuehniella* Zell. and *Anthrenus flavipes* Lec. (*vorax* Waterh.) and in adults of *Calandra granaria* (L.), but not in adults of *Oryzaephilus surinamensis* (L.) and *Iridomyrmex detectus* (F. Sm.), workers of *Coptotermes acinaciformis* (Frogg.) and larvae and adults of *Tribolium confusum* Duv. The general properties of the desulphydrases and the effects on them of various activators and inhibitors were investigated. When allowed to react with other sulphur-containing compounds, the extracts did not reduce methionine, homocysteine or thioglycollate, and their activity with glutathione was very slight; neither hydrogen sulphide nor cysteine was obtained from cystine.

It is concluded that desulphydrase activity may assist in the excretion of heavy metals as sulphides by larvae of *T. bisselliella*. In *Attagenus megatoma* (F.) (*piceus* (Ol.)) relatively weak desulphydrase activity is correlated with lack of sulphide formation and the excretion of relatively high quantities of cystine.

Stubbs (L. L.). **Strains of *Myzus persicae* (Sulz.) active and inactive with Respect to Virus Transmission.**—*Aust. J. biol. Sci.* **8** no. 1 pp. 68–74, 11 refs. Melbourne, 1955.

During work in Victoria with an unidentified persistent virus that causes a yellows disease of spinach and is transmitted by *Myzus persicae* (Sulz.), transmission by this Aphid was found to be inconsistent. In an experiment in which apterae from a vigorous colony on healthy spinach were allowed to feed for 24 hours on one leaf of an infected plant and eight groups of five individuals were transferred at intervals of 24 hours to ten successive healthy spinach plants, two groups did not transmit, one was infective for up to nine days and another for up to seven days, and the rest transmitted on only one or two of the ten days on which transfers were made. Since these inconsistencies could not be related to variations in the source of the virus or in the test plants, apterae from the original colony were caged separately on infected plants and groups of five of their progeny were transferred on four successive days to healthy plants. Considerable variation was found in the capacity of the individual cultures to transmit, and the most infective were four times as efficient as the least. These results were confirmed in two similar experiments with four of the cultures, which again showed the same order of infectivity, though in one experiment, Aphids from two of low infectivity failed to transmit at all.

These findings are discussed with reference to the literature, and it is considered that inactive individuals may occur more commonly among vector species than is at present realised. If, in attempts to reduce variables in work on vector relations by using colonies derived from single parents, the selected parent should be of only slight or moderate effectiveness as a vector, the data obtained might lead to invalid conclusions.

O'Connor (B. A.). **The Rhinoceros Beetle (*Oryctes rhinoceros* L.) in Fiji.** —*Agric. J. Fiji* **24** no. 1–2 pp. 35–46, 5 figs., 1 ref. Suva, 1953.

Oryctes rhinoceros (L.) was found early in 1953 for the first time in Fiji, at Suva, on the island of Viti Levu [*cf. R.A.E.*, A **41** 384], and a campaign,

an account of which is given, was begun in March for its eradication, and, when that proved impossible, for its control and for the prevention of spread to the other islands of the group, which are the more important for the production of copra. Within six months, damage to coconut was observed at places 70 miles apart along the southern coast and up to 20 miles inland, and the beetle itself was found in a narrow coastal strip about 30 miles long. Infestation was light and scattered. Descriptions are given of the adult and larva, with characters by which they can be readily distinguished from those of other species occurring locally, and of the damage caused to coconut.

In addition to applying the usual control measures [*cf.* **42** 215], experiments were begun to develop a compost trap that would kill the beetles entering it to oviposit. Compost treated with wettable powders containing BHC or lindane [almost pure γ BHC] gave good mortality of adults confined with it in the laboratory, a dieldrin emulsion concentrate proving somewhat less effective, and subsequent studies were directed towards improving the attractiveness of compost for the beetles. When adults were released each night for over a month in a large outdoor cage with easy access to drums containing compost alone, megass or mixtures of various materials in compost, the numbers found in the mornings in the drums containing compost with coconut meal or meat meal were about double those in compost alone, and no other mixtures proved as attractive. In a further test, sawdust was used as the base, with the addition of coconut or meat meal, and wettable BHC or lindane was mixed with it at the rate of a little over 1 oz. γ BHC per 10 cu. ft. Other drums contained compost alone, or sawdust alone or with coconut or meat meal. Over a period of 15 days, 117 adults were successively introduced into the cage, and of these, 91 were later found dead or apparently dying in or near the drums containing the materials treated with insecticide (only five of those thought moribund eventually recovering), ten were found dead or dying in or near the untreated drums, and eight were found alive in the latter. The remaining eight were assumed to be feeding in the two small palms provided as food. It is thought from previous observations that about a third of the beetles died from natural causes. Both BHC and lindane appeared to act more rapidly in sawdust than in compost, and the sawdust appeared to reduce the objectionable smell of the BHC.

Adults confined in tins with compost and pieces of sugar-cane as food survived for considerable periods, one male doing so for more than five months, and others survived for up to three months without food. The beetles apparently feed little, and intense attack would be necessary to kill a palm directly. The two palms in the outdoor cage, which were of a dwarf variety and about four years old, harboured an average of 11 beetles each for 32 days, but the growing points were not destroyed. It was estimated from observations during the tests that approximately 30 per cent. of the life of the adult was spent in the palm-crown.

Observations on natural enemies showed that *Plaesius javanus* Erichs., which was introduced into Fiji against the banana weevil borer [*Cosmopolites sordidus* (Germ.)] [*cf.* **24** 121, etc.] destroyed large larvae of *Oryctes* in the laboratory. *Pachylister chinensis* (Quens.), which has been observed to attack the young larvae in Samoa [*cf.* **42** 104], is also present in Fiji, having been introduced from Malaya. Both are of potential value against *Oryctes*. In May and June, shipments of predacious beetles were received from Trinidad. These included the Histerids, *Hololepta marginepunctata* Mars. (*Lecionota colombiana* Mars.) and *H.* (*L.*) *quadridentata* (F.), and probably a third species of the same genus, which were reported to prey on larvae of *C. sordidus*. In the laboratory in Fiji, they fed also on young

Oryctes larvae. The consignments also included the predacious Elaterid, *Pyrophorus pellucens* Eschscholtz. All these predators were released near the Tamavua River, where infestation was reported to be heaviest, and some of the Histerids near Nausori.

Pschorn-Walcher (H.) & Herting (B.). **Der kleine Frostspanner als Problem der biologischen Schädlingsbekämpfung.** [*Operophtera brumata* as a Problem of Biological Control.]—*Schweiz. Z. Obst- u. Weinb.* **64** no. 6 pp. 113–116, 6 figs. Berne, 1955.

In view of the establishment of *Operophtera* (*Cheimatobia*) *brumata* (L.) in Nova Scotia [*cf. R.A.E.*, A **44** 226] and its comparative freedom from parasites there, the introduction of suitable species from Europe was considered advisable. In the spring of 1954, 10,800 full-fed larvae were collected from cherry in western Switzerland and transferred to special cages. Some 30 per cent. of the resulting pupae proved to be parasitised, but as many died prematurely, the actual percentage was doubtless higher. The primary parasites reared included three Hymenoptera, *Agrypon flavcolatum* (Grav.), *Apanteles juniperatae* (Bch.) and *Eulophus* (*Comedo*) *larvarum* (L.), which were of little significance, and four Tachinids. The chief of these was *Monochaeta* (*Cyzenis*) *albicans* (Fall.), which comprised 90 per cent. of all the parasites reared and has one generation a year, its eggs being laid on the leaves in spring and subsequently ingested by the larvae of *O. brumata*, and the others were *Phorocera obscura* (Fall.), *Lypha dubia* (Fall.) and *Zenillia* (*Phryxe*) *nemea* (Mg.), which was rare. Puparia of all four Tachinids, a key to which is given, were forwarded to Canada, where the adults that emerged in spring were to be released in the field.

Allen (W. R.) & Kelleher (J. S.). **Experiments on the chemical Control of the Sweetclover Weevil,** *Sitona cylindricollis* **Fahr. (Coleoptera: Curculionidae).**—*Canad. J. agric. Sci.* **34** no. 5 pp. 483–487, 5 refs. Ottawa, 1954.

The value of synthetic organic insecticides against *Sitona cylindricollis* Fhs. on sweet clover [*Melilotus*] was investigated in Manitoba during 1949–52. Sprays were applied at a rate of 80 gals. per acre in late August or September, when the adults were congregated along the edges of the fields, and mortality was assessed ten days later by means of Abbott's formula [*cf. R.A.E.*, A **13** 331]. Mortalities of 75 per cent. or more were given by wettable parathion, dieldrin or EPN [O-ethyl O-p-nitrophenyl benzenethiophosphonate] and by Metacide emulsion concentrate [parathion and methyl-parathion], all at a rate of 0·5 lb. toxicant per acre. Wettable DDT and wettable heptachlor gave comparable control at 1·5–2 and 1 lb. per acre, respectively, and wettable aldrin at 1 lb., endrin at 0·5 lb. in an emulsion concentrate and wettable chlordane at 2 lb. per acre gave 66, 64 and 61 per cent. mortality, respectively. DDT and chlordane at 1 lb., aldrin at 0·5 lb. and Metacide at 0·25 lb. toxicant per acre, as well as γ BHC, toxaphene, methoxy-DDT (methoxychlor) and isodrin, gave significantly inferior or inconsistent results. In 1952, mortality from DDT, dieldrin, aldrin and isodrin was similar whether they were used as wettable powders or emulsion concentrates. No correlation was observed between the results obtained and the weather.

In a subsidiary test in Saskatchewan, DDT and toxaphene at 2 lb., chlordane at 1·7 lb., and parathion at 0·5 lb. per acre were applied on 18th

and 28th May against the ovipositing females. Larval counts made 50 days after the second application showed average percentage reductions of only 26, 14, 46 and 32, respectively.

ROBERTS (D. W. A.). **Sawfly Resistance in Wheat. I. Types of Resistance.**—*Canad. J. agric. Sci.* **34** no. 6 pp. 582–597, 10 refs. Ottawa, 1954.

In view of the discovery that Rescue wheat, a solid-stemmed variety resistant to damage by *Cephus cinctus* Nort., is in fact susceptible under certain conditions [*cf. R.A.E.*, A **37** 233], studies were made in Canada during 1950–52 in which two other varieties of *Triticum vulgare*, two of *T. durum* and two hybrids that varied in susceptibility and hollowness of stem were compared with it. The wheat was sown on dry land in plots that either adjoined severe natural infestations or were artificially infested. After the plants had matured, the stubs in each plot were counted, and the stems that were not cut were split and examined for infestation, the survival of eggs and first-instar larvae and the survival of older larvae. Significant differences were found between varieties in the percentage of infested stems, the percentage of larvae that hatched and survived up to the feeding stage, and the percentage that damaged the stems. The order of increasing larval survival among the varieties differed from that of increasing infestation or increasing egg survival and varied from year to year. The genetic factors in the wheat responsible for egg survival probably differ, at least in part, from those responsible for the survival of the older larvae and also from those that determine the degree of infestation. It is therefore unlikely that any single morphological character can give an accurate measure of resistance to *C. cinctus*, though solidness of stem may be one of the factors contributing to it.

BAKER (V. H.), TABOADA (O.) & WIANT (D. E.). **Lethal Effect of Electrons on Insects infesting Wheat and Flour—Part I.**—*Agric. Engng* **34** no. 11 pp. 755–758, 9 figs., 11 refs. Saint Joseph, Mich., 1953. **Lethal Effects of Electrons on Insects which infest Wheat, Flour, and Beans —Part II.**—*Op. cit.* **35** no. 6 pp. 407–410, 6 figs., 11 refs. 1954. **Some Effects of accelerated Electrons or Cathode Rays on certain Insects and on the Wheat and Flour which they infest.**—*Quart. Bull. Mich. agric. Exp. Sta.* **36** no. 1 pp. 94–106, 12 figs., 11 refs. East Lansing, Mich., 1953. **Some Effects of accelerated Electrons or Cathode Rays on certain Insects and on the Wheat and Flour they infest. Part II.**—*T. c.* no. 4 pp. 448–461, 8 figs., 10 refs. 1954.

The following is virtually the authors' summary of the first paper, which contains an account of investigations in which wheat infested by *Calandra* (*Sitophilus*) *granaria* (L.) and *Tribolium confusum* Duv. was exposed in petri dishes to accelerated electrons (cathode rays or β-particles) on the conveyor belt of a Van de Graaff accelerator. The biological and chemical effects of accelerated electrons are the same as those of X-rays and γ-rays. No induced radioactivity is produced in the product at voltages below 21 million volts. The rise in temperature of a product irradiated with accelerated electrons is negligible when compared with the heat method of sterilisation. A dose of 100,000 rep (roentgens equivalent physical) raises the temperature of wheat or flour about 0·5°C. [0·9°F.]. The penetration of accelerated electrons into matter is less than that of X-rays of corresponding voltages, but their penetration is of sufficient magnitude to be

considered. The maximum penetration of 2 million volt electrons into wheat and flour, with a density of 0·74 gm. per cc., with the bottom and top of the layer receiving 60 per cent. of maximum ionisation, is about 0·35 inch, or about one inch when irradiated from top and bottom. The penetration of electrons into wheat and flour can be increased by increasing the accelerating voltage. The electron dose can be metered, thereby providing a continuous record of an uninterrupted flow of product on a conveyor belt beneath the electron beam.

Eggs of both insects were killed by an electron dose of 10,000 rep, and treatment with the same dose prevented the adults from reproducing. Examination immediately after treatment showed that a dose of 5×10^5 rep gave complete mortality of *Tribolium* adults and that one of $2{\cdot}5 \times 10^5$ rep gave complete kill of *Calandra* adults, and examination after a week that a dose of $2{\cdot}5 \times 10^5$ rep gave 92 per cent. mortality of *Tribolium* adults and one of 1×10^5 rep 82 per cent. kill of adults of *Calandra*. A dose of 10,000 rep was detrimental to wheat seed, and seed treated with doses above 1×10^5 rep germinated but did not emerge and grow. Preliminary baking tests made with flour and wheat that had received a dose of 5×10^5 rep indicated that a satisfactory loaf of whole wheat bread can be produced from treated flour. A taste panel detected a slight change in the flavour of bread made from the treated flour, but this change was not necessarily undesirable.

The second paper includes an account of further tests in which beans infested by *Bruchus* (*Acanthoscelides*) *obtectus* Say were treated in the same manner. An electron dose of 10,000 rep gave complete mortality of the Bruchid adults within a week and one of 100,000 rep killed 73 per cent. of them in 48 hours and all of them in a week. A dose of 1×10^5 rep was sufficient to prevent the insects from damaging the beans, but a dose as low as 10,000 rep injured bean seed. Various technical aspects of the experiments are discussed, and the literature on the effects of accelerated electrons on vitamins and enzymes is reviewed.

The last two papers are virtually identical with the first two.

Vergeer (T.). **The Cherry Fruitworm** (*Grapholitha packardi*) **as a Blueberry Pest in Michigan.**—*Quart. Bull. Mich. agric. Exp. Sta.* **36** no. 4 pp. 370–373, 7 refs. East Lansing, Mich., 1954.

Cydia (*Grapholitha*) *packardi* (Zell.) was found in Michigan for the first time in 1953, when it was observed infesting cultivated blueberries. Eggs were first found at the end of May or the beginning of June, and the larvae hatched within a week and entered the fruits, usually attacking the calyx half. They became full-fed by about the end of the month, left the fruits and hibernated in the pith of pruned twigs, into which they tunnelled, on the surface of twigs, or in cracks on the lower bark. Pupation occurred in the following May. Control measures are discussed, and the egg, larva and adult are briefly described.

Bean (J. L.) & Godwin (P. A.). **Description and Bionomics of a new Red Pine Scale,** *Matsucoccus resinosae*.—*For. Sci.* **1** no. 2 pp. 164–176, 10 figs., 26 refs. Washington, D.C., 1955.

Before 1946, the only species of *Matsucoccus* known to infest pines in the north-eastern United States was *M. gallicolus* Morr., which attacks mainly pitch pine and scrub pine (*Pinus rigida* and *P. virginiana*) [*cf. R.A.E.*, A **28** 351; **32** 151], but in November of that year red pines (*Pinus*

resinosa) near Easton, Connecticut, were found to be heavily infested by a hitherto unknown species here described from all stages as *Matsucoccus resinosae*, sp.n. This Coccid had spread four miles to the north-east by 1950, and it was found in 1953 over an area of at least 60 sq. miles in Connecticut and 40 sq. miles in New York. It occurred only in plantations, nurseries or ornamental plantings, in all cases south of the natural range of *P. resinosa*, and no other species of pine was infested naturally in the field or artificially in laboratory experiments. Severe infestation leads to discoloration of the foliage, swelling and cracking of the bark and usually death, and the Coccid has already constituted a serious threat to the extensive plantations of red pine established in the eastern States.

Observations on the bionomics of *M. resinosae* showed that the newly hatched crawlers sometimes travel considerable distances before settling. They are gregarious, gathering in large numbers under bark scales, the legless intermediate stages feed intensely and grow considerably before moulting to the adult females or preadult males. The latter congregate on the undersides of branches, especially at the axils, and spin fluffy cocoons almost immediately, in which they transform to the adult males. The adult females are active, and wandered for three days before ovipositing in the laboratory; the oviposition period lasted 2–4 days. There were two generations a year, the eggs being laid in May and in late August or early September, winter was passed in the first nymphal stage, and the adults emerged from early May to early July and in early August. The duration of the complete life-cycle was about 84 days for the first generation and 259 days for the second.

In preliminary spray tests, insecticides were applied on 22nd April, 19th May, 8th June or 27th June by mist blower or hydraulic sprayer. Systox [diethyl 2-(ethylmercapto)ethyl thiophosphate (demeton)] applied with the mist blower gave the best average results, but 2 per cent. oil emulsion applied in the same way proved superior to it on one occasion. No single treatment afforded satisfactory control. No parasites of *M. resinosae* were observed, but *Xenotracheliella inimica* Drake & Harris, *Cleis picta* (Rand.), *Hemerobius stigmaterus* Fitch, *Chrysopa* sp. and other predators were found feeding on the eggs and other stages; various spiders and also mites of the genus *Anystis* have been reported to feed on them.

Szumkowski (W.). **Observaciones sobre la biología de algunos Coccinellidae (Coleoptera).** [Observations on the Biology of some Coccinellids.]—*Bol. Ent. venezol.* **11** no. 1–2 pp. 77–96, 23 refs. Maracay, 1955. (With a Summary in English.)

Field and laboratory observations were made in 1948–50 on the insects attacked by Coccinellids that are common in Aragua and Carabobo, Venezuela. In the laboratory, larvae and adults of *Ceratomegilla* (*Colcomegilla*) *maculata* (Deg.) fed voraciously on the eggs and young larvae of *Alabama argillacea* (Hb.), *Laphygma frugiperda* (S. & A.), *Prodenia latifascia* Wlk. and *Agrotis repleta* Wlk. [*cf. R.A.E.*, A **43** 445], and also on the eggs of *Feltia subterranea* (F.), the larvae attacked eggs and larvae of *Diatraea lineolata* (Wlk.), and the adults fed unwillingly on eggs and nymphs of *Dysdercus* sp. When kept with *Aphis gossypii* Glov. on cotton leaves, seven larvae destroyed an average of 449 Aphids each, with a daily average of 45 and a maximum of 120, and the adults destroyed an average of 82 Aphids per day with a maximum of 125. Two adults destroyed three adults and four nymphs of *Saccharosydne saccharivora* (Westw.) in one day.

Larvae and adults of *Cycloneda sanguinea* (L.) fed, though somewhat less

readily than *Ceratomegilla*, on the eggs and larvae of *Alabama* and *Prodenia*, on the eggs of *Feltia* and on the larvae of *Laphygma*, *Agrotis* and *Diatraea*, and the newly hatched larvae also on the eggs of *Laphygma*. The adults destroyed nymphs of *Dysdercus* and adults of *Saccharosydne*. In the case of *Aphis gossypii*, four adults destroyed an average of 69 Aphids daily, with a maximum of 145. Larvae and adults of the two Coccinellids were often observed destroying the eggs of their own or the other species, even when *A. gossypii* was present. Neither attacked the eggs of *Sacadodes pyralis* Dyar. *Ceratomegilla* appeared to prefer the eggs of Lepidoptera, even when Aphids were present, but *Cycloneda* showed a preference for the Aphids. During rearing of *Ceratomegilla*, the egg, larval and pupal stages and the preoviposition period lasted 3–4, 9–17, 4–12 and 8–25 days, respectively. Two females laid totals of 373 and 568 eggs each during survival periods of 75 and 109 days, respectively. In similar studies with *Scymnus limbaticollis* Muls., *S. tardus* Muls., *Hyperaspis connectens* (Thnb.) and *H. festiva* Muls., Aphids were preferred to eggs and larvae of *Alabama* or eggs of *Laphygma*.

Investigations in the field in 1948–50 showed that *Ceratomegilla* and *Cycloneda* afforded good control of *L. frugiperda* on early maize sown near a lagoon in the dry season, when it is normally very susceptible to infestation, although no Aphids were present, and a correlation has been observed between the numbers of Coccinellids and those of *Alabama argillacea* on cotton.

Wille (J. E.), Simón (J. E.) & González (J. E.). **Los insectos e insecticidas en la campaña algodonera 1954–55.** [Insects and Insecticides in the Cotton Season 1954–55].—*Inf. Estac. exp. agric. La Molina* no. 97, [1 +] 20 pp., 5 figs., multigraph. Lima, 1955. (With a Summary in English.)

Weather conditions in central Peru in 1954–55 were unfavourable for the development of the cotton crop but favoured insect pests. Of the latter, the most injurious was *Anthonomus vestitus* Boh., which was found in all the valleys from September onwards and caused serious damage from December. *Dysdercus peruvianus* (Guér.) caused crop losses of 50 per cent. or more in the north and was particularly injurious in the valleys of Huarmey and Pativilca and in the upper Supe valley, persisting in the cotton fields from the previous season. In almost all areas, *Heliothis virescens* (F.) was held in check by natural enemies [*cf. R.A.E.*, A **44** 97]. *Anomis texana* Ril. was less numerous than in the previous season, but caused considerable damage between January and April. *Mescinia peruella* Schaus became injurious in February–April in several valleys, and *Aphis gossypii* Glov. was present in the same areas in large numbers in September–October, but was largely controlled by natural enemies. The Aphid was present in almost all the valleys in January–February, and insecticides were applied for its control. *Pseudococcus* spp. were present in many valleys and attacked 50–70 per cent. of the buds and bolls in several near Lima, but natural enemies afforded satisfactory control in February. *Eulia* (*Argyrotaenia*) *sphalcropa* (Meyr.), which caused damage in the Cañete valley in 1953–54, appeared to be extending its distribution and was found in all the coastal valleys. Other pests of slight or only local importance are reviewed more briefly. In work on control by means of insecticides, toxaphene dusts were effective against cutworms, but less so against *Anomis texana* than in previous years, reinfestation being rapid. They were not effective against the Aphid or *Heliothis*, and increased infestation by the latter, *Anthonomus*, *Mescinia* and *Pseudococcus*. DDT in dusts and sprays gave adequate

control of *Heliothis*, but repeated applications resulted in increases in the Aphid and *Pseudococcus*. A dust of 5 per cent. DDT and sulphur gave excellent control of *Empoasca*, but destroyed beneficial insects. BHC in dusts gave almost complete control of *Dysdercus*, but reinfestation quickly followed; it also destroyed the natural enemies of *Bucculatrix thurberiella* Busck and permitted the latter to increase. It proved effective against cutworms when incorporated into the soil and against the Aphid when applied in a dust, but proved inadequate against *Anomis* and resulted in an increase of *Heliothis* through the destruction of natural enemies. Aldrin did not control *Anomis*, but gave good control of cutworms when incorporated into the soil and of *Anthonomus* when applied to the plants several times, but resulted in an increase of *Heliothis* after the second application. Parathion in sprays gave more than 90 per cent. control of *Dysdercus*, *Aphis*, *Bucculatrix* and *Anomis*, and a mixture of parathion and aldrin gave almost complete control of *Anthonomus*. EPN [ethyl p-nitrophenyl thionobenzene phosphonate] gave good control of *Aphis*, *Anomis* and *Bucculatrix*, but was ineffective against *Anthonomus*. Calcium arsenate, alone, with sulphur or with nicotine sulphate, controlled *Anomis* and also *Heliothis* feeding on the leaves, lead arsenate sprays also controlled *Anomis*, repeated and heavy applications of sulphur dusts controlled thrips, *Empoasca*, and *Oligonychus* (*Paratetranychus*) *peruvianus* (McG.), and nicotine sulphate gave good control of the Aphid. It is pointed out that these older materials proved just as effective in many cases as the newer organic compounds, without disturbing biological control, and their use is recommended.

Metcalf (R. L.). **Organic Insecticides. Their Chemistry and Mode of Action.**—9¼ × 6 ins., x + 392 pp., 7 figs., many refs. New York, N.Y. & London, Interscience Publ., Inc., 1955. Price £3 8*s*. or $8.50.

This book is a greatly expanded version of an earlier work [*R.A.E.*, A **37** 481] and is based on literature published up to 1955. Additional chapters deal with cyclodienes (with which toxaphene is included [*cf.* **40** 372]), carbamates, miscellaneous insecticides (including some of plant origin) and acaricides, and the scope of the information given has been extended by discussions of toxicity to mammals. Of the other two additional chapters, one is devoted to synergism and other types of joint action between insecticides, and the other to various aspects of acquired resistance to insecticides in house-flies (*Musca domestica* L.).

Distribution Maps of Insect Pests.—Series A, nos. 61–66. London, Commonw. Inst. Ent., 1956.

These maps are nos. 61–66 of a series already noticed [*R.A.E.*, A **40** 203; **44** 7] and deal, respectively, with *Prodenia litura* (F.), *Saccharosydne saccharivora* (Westw.), *Sminthurus viridis* (L.), *Dacus cucurbitae* Coq., *Rhagoletis cerasi* (L.) and *Scyphophorus interstitialis* Gylh. (*acupunctatus* Gylh.).

Smieton (M. J.) & Montgomery (N.). **The Infestation of Winter Lettuce by Aphids and its Control.**—*Ann. appl. Biol.* **44** no. 1 pp. 67–79, 2 graphs, 7 refs. London, 1956.

Observations were made in the Thames Valley during 1947–48 and 1949–54 on the infestation of winter lettuce by Aphids [*cf. R.A.E.*, A **40** 39] and

the effects on it of transplanting and the application of insecticides. The principal Aphid concerned was *Myzus* (*Nasonovia*) *ribis-nigri* (Mosley), but *M. persicae* (Sulz.), which is the main vector of lettuce mosaic, *M. ascalonicus* Doncaster and *Macrosiphum solanifolii* Ashm. (*euphorbiae*, auct.) were also present. Infestation was negligible during the winters of 1950–51 and 1952–53, but it increased gradually from October in the other years and had reached 80 per cent. or more by February in some of them. Lettuce mosaic was prevalent in some seasons, but was not correlated with gross Aphid abundance. Lettuces from seed drilled in the field in September and thinned in spring were ready for cutting a little earlier than those transplanted from seed beds in November, but in comparison with the latter, they were heavily infested in years in which Aphids were common and very few of them formed firm hearts. Early and persistent infestation, even in the absence of lettuce mosaic, greatly reduced both the number of plants that formed hearts and their average weight, and late attack by alates in early spring sometimes spoiled the fully matured plants.

A proprietary dust of 5 per cent. crude BHC in china clay, applied to the seedlings at about 10·2–15·7 gm. per 100 plants immediately prior to transplanting in November 1951, gave good control of Aphids; only 1·6 per cent. of the treated plants showed appreciable infestation in April 1952. When transplanting was delayed until February or March, three applications made at the end of November, in mid-December, and in mid-February gave a 19-fold increase in the yield of large lettuces; a single application in mid-February was almost as effective in a season with persistent, heavy infestation, and one in mid-December also resulted in increased yields of large lettuces, though most were infested. Losses due to fungus disease were usually high among plants transplanted in spring. The dust did not damage the plants or taint the crop at 4–12 gm. per 100 plants. Dipping the seedlings in 0·05–0·06 per cent. nicotine prior to transplanting [**28** 299] in November 1949 was rather less effective, but infestation was reduced from 93 to 33 per cent. in April 1950. In 1947–48, when lettuce mosaic disease was prevalent, and in 1950–51, when both Aphids and virus infection were of negligible importance, there was no significant difference between treated and untreated plants.

Silberschmidt (K.) & Tommasi (L. R.). **A Solanaceous Host of the Virus of 'Infectious Chlorosis' of Malvaceae.**—*Ann. appl. Biol.* **44** no. 1 pp. 161–165, 1 pl., 21 refs. London, 1956.

Viruses transmitted by Aleurodids occur commonly in solanaceous and malvaceous species, and infected plants of the two families often show similar symptoms. It has been assumed in consequence that the virus of tobacco leaf-curl infects malvaceous plants and that that of cotton leaf-curl possibly infects solanaceous plants, although attempts to obtain experimental proof have failed [*cf. R.A.E.*, A **21** 106; **23** 692], and other experimental evidence indicated that viruses transmitted by Aleurodids have a restricted host-range even among the plants in one family [*cf.* **43** 276]. In the experiment here described, batches of six adults of *Bemisia tabaci* (Gennadius) reared on the malvaceous *Sida rhombifolia* showing symptoms of infectious chlorosis [*cf.* **35** 86] transmitted the disease to healthy young plants of the solanaceous *Nicandra physaloides*. Furthermore, adults taken from the stock colonies reared on healthy *S. rhombifolia* and allowed to feed for 24 hours on the infected *N. physaloides* transmitted the disease to healthy seedlings of both *S. rhombifolia* and *N. physaloides* to which they were transferred. Attempts to transmit it to tobacco seedlings

by means of infected *B. tabaci* were unsuccessful. The authors state in a foot-note that A. S. Costa has also obtained transmission of infectious chlorosis to *N. physaloidcs* and other species. From a consideration of the symptoms produced by infectious chlorosis in *N. physaloides*, it is concluded that the virus is distinct from those causing leaf-curl in tobacco and cotton, respectively.

Howe (R. W.). **A Method for obtaining a controlled daily Temperature Cycle.**—*Ann. appl. Biol.* **44** no. 1 pp. 188–194, 1 pl., 5 figs., 3 refs. London, 1956.

The following is the author's summary. An apparatus is described which gives a controlled daily cycle of temperature. The hand of a 24-hr. clock is connected by a rod to the arm operating a thermostat contact and moves the contact slowly backwards and forwards. Its method of use is described and the shape of curve it produces is expressed as a mathematical formula. A method of obtaining a nearly constant relative humidity is described.

Živojinović [Zhivoyinovit'] (S.). **Obična borova zolja na Maljenu. Istorijat gradacije i posledice golobrsta na crnom boru.** [The Common Pine Sawfly in the Malyen. The History of the Outbreak and Consequences of the Defoliation of Black Pine.]—*Plant Prot.* no. 24 pp. 3–19, 4 pls., 1 fig., 6 refs. Belgrade, 1954. (With a Summary in English.)

Maksimović (M.). **Ciklus razvića obične borove zolje i njena masovna pojava na Maljenu 1951–1952 godine.** [The Cycle of Development of the Common Pine Sawfly and its Mass Appearance in the Malyen in 1951–52.]—*T. c.* pp. 20–40, 2 pls., 5 figs., 13 refs. (With a Summary in English.)

The mountains known as the Malyen are a small group to the south of Belgrade covering about 10 sq. miles and ranging in height from about 1,600 to 3,600 ft. They are almost entirely covered by forests of black pine (*Pinus nigra*) and are of importance as being almost the only place in Serbia where this species grows naturally. The forests are in a bad condition, however, owing to excessive felling during the late war, and this and overgrazing has led to soil erosion. An attempt to rehabilitate the area was in view, but a serious outbreak of *Diprion pini* (L.) began in 1950.

Observations on the outbreak are recorded in the first paper. In 1950, the larvae were first observed in July in five localities feeding on the pine needles, and defoliation by the second generation in August and September affected a total area of some 74 acres. In 1951, eggs of the first generation were found in May over an area of 3·8 sq. miles, and larvae of the second generation occurred over the entire territory in July–September. Some mortality was caused by hail in August, and some by polyhedral disease. Development was protracted, mature larvae still being present in October, when cold spells set in. During these, the larvae congregated on the trunks and became torpid, but with the return of warm weather they dispersed over the trees and resumed feeding. The eggs were heavily parasitised by *Acrysocharclla ruforum* (Krausse), and the larvae and pupae by unspecified Tachinids and Ichneumonids. An enormous number of larvae spun cocoons in autumn, but infestation was not abnormal in 1952, most of the population remaining in diapause in cocoons in the soil and not giving rise to adults until the middle of June 1953. In that year, the second generation reached outbreak numbers in August, and the infestation was as severe as in 1951. Some control was again afforded by parasites.

In tests on chemical control in 1953, proprietary DDT sprays applied from knapsack sprayers gave good results against first-generation larvae over about 123 acres, and a campaign was organised against the second generation. The methods used comprised destruction of the larval nests, spraying with DDT as before, and the application of mist sprays of DDT from ground apparatus and aircraft, and good control was obtained over 1,482 acres.

Investigations on the effect of the outbreak on the trees in 1953 showed that the needles that grew on the trees defoliated in 1951 were much shorter than usual, their distribution on the twigs was abnormal, the annual increase in growth was reduced, a great many trees drying up, and few cones were produced, so that the seed yield was poor. In addition, the trees were attacked by secondary pests, of which *Pityophthorus glabratus* Eichh. and *Pissodes notatus* (F.) were the most numerous. *Pissodes* increased to outbreak numbers on young pines and seedlings in 1953.

The second paper comprises an account of observations on the bionomics of *D. pini*, the results of which are compared with those of other workers [*cf. R.A.E.*, A **20** 313, 489; **23** 751; **31** 122]. All stages of the sawfly are described. There were two generations a year, the adults of the overwintered one appearing in early May and those of the first generation in the second half of July. Emergence from the cocoons continued for over 20 days, and the ratio of males to females in 1951 was 1:2. In glass cylinders at a relative humidity of 100 per cent. and a temperature of 18–32°C. [64·4–89·6°F.], the males lived for 1–12 days, with an average of 4·24, and the females for 2–11 days, with an average of 4·87, and the total number of eggs laid per female ranged from 6 to 97, with an average of 6·8. In special observations in the forest, however, the average number of eggs laid per female was estimated at nearly 60. They were laid at the rate of 2–31 per needle and in 31·7 per cent. of cases, oviposition occurred in both needles of a pair. At temperatures of 8–32°C. [46·4–89·6°F.], the second-generation eggs hatched in 16 days. The manner of feeding of the larvae is described. Cocoons of the first generation occurred on the ground, on vegetation and under the bark of trees, and those of the second generation in the soil and to a less extent on grass and branches. A small percentage of the first-generation eonymphs entered diapause, but all those of the second generation did so, some of them not giving rise to adults for several years. Thus, about 90 per cent. of cocoons taken from the soil in mid-May 1951 and placed in soil in glass containers still contained individuals in diapause at the end of April 1952, and over 17 per cent. were still unchanged in September 1953.

Pušin (V.) & Pobegajlo (I.). **Kalifornski štitaš i njegova pojava u Jugoslaviji.** [*Quadraspidiotus perniciosus* and its Appearance in Yugoslavia.]—*Plant Prot.* no. 24 pp. 49–78, 2 pls. (1 col.), 7 figs., 56 refs. Belgrade, 1954. (With a Summary in English.)

The authors review the distribution of *Quadraspidiotus* (*Aspidiotus*) *perniciosus* (Comst.) in Yugoslavia, which is still increasing [*cf. R.A.E.*, A **43** 128, etc.], describe all stages of that Coccid and give an account of observations on its bionomics near Belgrade, the results of which resemble those recorded from Italy [*cf.* **41** 341, etc.]. There were usually three overlapping generations a year, but the third may be only partial in cool wet years and there is sometimes a fourth in years in which the spring is early and warm weather persists until late autumn, though it does not normally survive the winter. Crawlers were observed as late as 20th December, when the nights were already frosty but the days sunny and

warm. The three main generations were usually present from mid-May to about mid-July, from mid-July to about 10th September, and from the beginning of September onwards.

Development continued during winter, the nymphs mostly being in the second instar from mid-January, but mortality ranged from 40 to 85 and sometimes reached 90 per cent. The adult males appeared about 20th April, some 10–15 days before the females reached sexual maturity. The latter produced a total of 60–80 crawlers each, and those of the first generation usually about 100–120, the period of reproduction lasting 40–50 days. The crawlers became fixed in less than a day, those of the first generation establishing themselves on the bark and those of the second generation on the fruits of the food-plants. Complete development lasted 52–67 and 40–49 days for females of the first and second generations, respectively, and 38–42 and 33 days for the males. Details of the individual stages are given.

The main food-plants were currant and apple, pears and stone fruits being much less attacked, even when growing in close proximity to heavily infested plants, and scales transferred to stone fruits in the laboratory from apple soon dying out. Spread is effected chiefly by the transport of infested nursery stock [*cf.* **36** 64]. In special observations, crawlers did not pass from apples or apple parings to surrounding objects, though they readily became established on the trunks of apple or pear if the substrate was placed in direct contact with them. Such direct contact in the field would, however, be extremely rare.

Prešeren (T.). **Suzbijanje muhe trešnjarice u Slovenskom Primorju.** [The Control of the Cherry Fly on the Coast of Slovenia.]—*Plant Prot.* no. 24 pp. 79–86, 5 refs. Belgrade, 1954. (With a Summary in German.)

In Yugoslavia, *Rhagoletis cerasi* (L.) has become of increasing importance as a pest of cherries in the coastal region of Slovenia, and in view of the good control of this fruit-fly obtained in Switzerland with a combined spray of DDT and parathion [*cf. R.A.E.*, A **43** 31], an experiment on the value of such a combination was carried out in 1953. The spray used contained 0·1 per cent. DDT and 0·01 per cent. parathion, and it was applied once, between 18th and 24th May, to varieties ripening at the end of May or the beginning of June, and twice, between 18th and 30th May, to varieties ripening after 5th June, over 18,000 trees being treated in all. Examination of fruits at harvest showed that the percentage infestation was reduced from 30–64 to 0–6 and from 18–58 to 1–7, respectively. It is concluded that the fruit-fly can be effectively controlled by such sprays, provided that all the fruits are covered.

Tominić (A.). **Biološka ispitivanja muha** *Carpomyia vesuviana* **A. Costa.** [Biological Investigations on *C. vesuviana.*]—*Plant Prot.* no. 24 pp. 92–97, 1 ref. Belgrade, 1954. (With a Summary in English.)

Jujube trees (*Zizyphus sativa*) have long been established on the Dalmatian coast of Yugoslavia and have been increasingly grown owing to the demand for the fruits. The latter are infested by *Carpomyia vesuviana* Costa, which is apparently spreading, and the bionomics and control of this fruit-fly were accordingly investigated in 1952–53.

In an insectary, under conditions resembling those in the field, the adults from the overwintered larvae began to emerge from the soil on 7th July, and all had done so by the end of the month. There was a second emergence at the end of August and the beginning of September, but this generation was

less numerous than the earlier one, and unlike the latter, consisted chiefly of males. The adults lived for 40–70 days, the preoviposition period lasting eight days. Eggs, of which a female laid an average total of 140–280, were deposited over a period of 35–65 days, usually singly, under the cuticle of the tip of the ripening fruits, green or fully ripe fruits being avoided. The eggs hatched in 4–5 days, and fruits infested by more than 2–3 larvae dropped to the ground. The feeding stage lasted about 12 days in August and the full-fed larvae entered the soil, the last in 1952 doing so at the beginning of October.

In preliminary tests on control, adults confined for 7–10 minutes in a glass cage that had been sprayed with 0·2 per cent. DDT ten days previously all died in a few hours, but similar deposits of 0·02 per cent. parathion were effective only on the day of application and BHC had no effect. When applied against the eggs, 0·04 per cent. parathion did not kill them, but the larvae died shortly after having entered the fruits; at 0·06–0·1 per cent. the development of the eggs was arrested and the larvae in them killed. In field tests, a spray of 0·2 per cent. DDT was applied rather late, on 16th July, ten days after the appearance of the adults. Some of the trees were close to the sea and some were inland, and the results were estimated on 30th July and again on 23rd August. Near the sea, the percentages of fruits infested on untreated and treated trees were 75 and 1, respectively, on the first date and 60 and 10 on the second. Inland, the infestation was reduced from 76 to 4 per cent. on the first date, but was 90 per cent. on both treated and untreated trees on the second date.

It is suggested that two applications of DDT, the first at the beginning of July and the second about a month later, would afford satisfactory control. They should be timed according to the date of appearance of the adults and their activity.

Klostermeyer (E. C.). **Entomological Aspects of the Potato Leaf Roll Problem in Central Washington.**—*Tech. Bull. Wash. agric. exp. Sta.* no. 9, [3+] 42 pp., 5 figs., 67 refs. Pullman, Wash., 1953.

Leaf-roll has been the main limiting factor in the production of potatoes in central Washington since about 1943. *Myzus persicae* (Sulz.) is the chief vector of the virus, and various aspects of transmission were investigated in 1949–51. The following is based on the author's summary of the results.

In laboratory tests in which *Physalis angulata* was the indicator plant, batches of five apterae of *M. persicae* transmitted the leaf-roll virus after an acquisition feeding period of ten minutes on infected potato or *Physalis* and an inoculation feeding period of ten minutes, these being the shortest periods tested; the Aphids remained infective for at least six days. There was no evidence of a long latent period in the vectors [*cf. R.A.E.*, A **43** 61, etc.], though more infections were obtained with an acquisition feeding period of 48 hours than with shorter ones. Attempts to distinguish infective from non-infective Aphids by means of paper partition chromatography were unsuccessful.

The presence of infective *M. persicae* in the field was determined by allowing field-collected individuals to feed on *P. angulata*. The proportion of infective individuals in a population was small on the early crops, but relatively large among alates collected on late potatoes after they had migrated from early and mid-season crops. The frequency of leaf-roll infection in potato plants was related to the frequency of infestation by Aphids, and both Aphids and infected plants were more numerous at the edges of the fields. The migration of alates and their distribution within

a field were studied by means of pans painted yellow inside and filled with water [*cf.* **39** 359]. More Aphids were trapped at the edges than in the middle of the field. The size of the apterous population that developed in the field was closely associated with the number of alates trapped. Only small numbers of alates were taken in the traps between 23rd July and 10th August, when the daily maximum temperatures exceeded 90°F.

When 2-oz. seed pieces were immersed for 15 minutes in 0·001–0·25 per cent. Systox (diethyl 2-(ethylmercapto)ethyl thiophosphate [demeton]) or schradan (Pestox 3) before planting, the higher concentrations resulted in plants that were toxic to Aphids for some days, but they also caused a severe reduction of plant growth. In field tests in 1950–51, good control of *M. persicae* and reduction in the spread of leaf-roll were given by contact insecticides having a rapid action and prolonged residual effectiveness. Good control of the Aphid was given by four applications of a dust mixture affording 7·2 lb. DDT and 72·3 lb. sulphur per acre, by one affording 8·4 lb. DDT, 84 lb. sulphur and 0·8 lb. parathion per acre, and by a spray applied to give 7·5 lb. DDT and 0·8 lb. parathion per acre. Demeton and schradan applied four times in sprays at 1·5 and 4·8 lb. toxicant per acre, respectively, reduced Aphid populations to a very low level but permitted more leaf-roll transmission per unit of Aphid population than did the more rapid contact insecticides. The results suggest that, to prevent the spread of leaf-roll, alates must be killed before feeding on more than one plant.

The only insect other than Aphids numerous enough to constitute a potential vector of leaf-roll was *Aleurodes spiraeoides* Quaint., but only negative results were obtained in 198 transmission tests involving 4,361 examples of this Aleurodid.

Hille Ris Lambers (D.), Reestman (A. J.) & Schepers (A.). **Insecticides against Aphid Vectors of Potato Viruses.**—*Netherlands J. agric. Sci.* **1** no. 3 pp. 188–201, 5 refs. Wageningen, 1953.

Experiments were carried out on potato in Holland in 1951 to investigate the effects of Systox (diethyl 2-(ethylmercapto)ethyl thiophosphate [demeton]) and DDT on the Aphid vectors of leaf-roll and virus Y, their natural enemies and the yield of tubers, and the effect of demeton on the spread of the two viruses [*cf. R.A.E.*, A **43** 61], of which the former is of the persistent type and the latter non-persistent. The experimental plots were surrounded and divided from each other by double rows of densely-sown oats, which have been shown to prevent migration between plots. In those treated with demeton, the middle row was planted with tubers from infected plants, and ten rows of virus-free tubers were planted on either side. The plants were sprayed with 0·1 per cent. demeton at about 117 gals. per acre on 25th May, when they first came up, and at about 180 gals. on 7th, 16th and 22nd June, 3rd, 14th and 25th July, and 3rd August. No infected tubers were planted in the DDT plots, and a spray of 0·4 per cent. wettable DDT was applied on 11th and 20th June, and 3rd, 13th and 25th July. Control plots were sprayed with water only.

Aphid counts, the results of which are shown in tables, were made some 8–9 days after spray applications, by examining 10–50 plants and counting, on one stem, the Aphids on the largest leaf at the bottom, the largest leaf halfway up, and the whole of the apex, including incompletely opened leaves. Of the Aphids observed, only *Myzus persicae* (Sulz.) and *Aphis nasturtii* Kalt. were sufficiently numerous to be considered. The demeton-treated plots remained free from Aphids until 29th June, and though large numbers of alates of *M. persicae* were present from that date until 24th July and reproduced, no second-instar nymphs were found. In a subsidiary test, alates of

M. persicae confined with leaves of a plant treated 8–9 days previously all died within 24 hours. Colonisation between treatments, and nymphal development, had therefore been rendered impossible. Spraying the upper surfaces of the leaves with DDT initially reduced the populations of *M. persicae* and spraying both surfaces did so still further, but populations were ultimately higher on the treated plots than on the controls. The effects of the insecticides on *A. nasturtii* were similar. One of the control plots was sprayed with demeton in error on 16th June, and subsequent observations showed that no Aphids survived on the plants until about 12 days later, the effect of this single treatment on the population as a whole being comparable with that of regular intensive spraying with DDT.

Counts of natural enemies of the Aphids (Syrphids and Coccinellids) appeared to indicate that they were killed by the demeton treatments, but the authors point out that they could have been affected by them only during the actual spraying period, and furthermore that the density of predators is apparently dependent on the Aphid population, so that a reduction in the latter automatically results in a reduction in oviposition by the former. There was some evidence, however, that the increase in Aphids following treatment with DDT was more directly due to destruction of natural enemies. Counts on 16th July showed that the number of leaves shed per stem was not affected by demeton but was 1·5 when both leaf surfaces were treated with DDT, 2·5 when only the upper surface was treated and 3·5 for no treatment. Both insecticides increased the yield of tubers slightly but significantly.

Two tubers from each of the plants (except those used as sources of virus infection) were harvested and planted in 1952 in such a way that two fields resulted in each of which each plant had the same position as the parent plant in the previous year. Each field was repeatedly examined for virus disease, and the results are shown on figures and discussed. If one or both of the resulting plants showed infection it was considered that the parent plant had become infected in 1951. It thus appeared that about 20 per cent. of the plants exposed to leaf-roll and sprayed with demeton had become infected, as compared with 34·1 per cent. in the controls. The distribution of the infected plants was regular throughout the sprayed plots, however, indicating that the treatment had suppressed the influence on adjacent plants of the sources of infection with a persistent virus, whereas in the controls the percentage of plants infected was considerably higher in the first 3–4 rows parallel to the sources of infection than in the other rows (except those near the oat screens, where alates attempting to leave the plots had been prevented from doing so). The percentage of plants infected with leaf-roll in the 4th–8th rows in both demeton-treated and control plots was 18–28, and it is assumed that this represents infection due to Aphids that were already infective when they entered the plots.

In the plots that contained the sources of infection with virus Y and were treated with demeton, infection in the other rows averaged 60·4 per cent., ranging from 87 in the row adjacent to the source of infection to 42 in the 8th and 9th rows. When no source was present and the plots were treated with demeton, 16·9 per cent. of the plants became infected, and when a similar plot was sprayed with water (and once, in error, with demeton) the percentage was 13·8. In the last two cases, infection is ascribed to transmission by Aphids carrying the virus when they entered the plots. The validity of the method employed for assessing virus infection is discussed, and it is concluded that the experiments explain the frequently observed absence of correlation between Aphid counts and the incidence of infection. Since the whole of the standing Aphid population was destroyed in the plots sprayed with demeton, the infection that occurred must have resulted

from immigrant alates. These are highly mobile and usually escape detection by ordinary methods of population assessment. The difference in the spread of leaf-roll and virus Y agrees very well with the theory of persistent and non-persistent viruses [*cf.* **29** 26]. Virus-free Aphids that acquired the leaf-roll virus from plants treated with demeton died too soon to become infective, but those acquiring virus Y became infective long before they died [*cf.* **43** 61]. No known aphicide could much reduce the spread of virus Y by Aphids entering the field. Treatment with demeton will have little effect on virus transmission if there are no sources of infection within the field when the Aphids arrive. In practice, however, these are usually present, since it is seldom possible to remove all infected plants in time, especially those infected with leaf-roll, the symptoms of which do not appear sufficiently early. Spraying the whole field would make it possible to postpone the removal of plants infected with leaf-roll until symptoms become distinct and prevent the dissemination of infected Aphids at the time of removal. As demeton is dangerous to the worker, however, it is suggested that the spray be applied only to infected plants and those suspected of infection, roguing being carried out at a later date. If a dye were added to the spray, the roguing could be done by unskilled persons.

Steinhaus (E. A.). **The Effects of Disease on Insect Populations.**—*Hilgardia* **23** no. 9 pp. 197–261, 2 graphs, 7 pp. refs. Berkeley, Cal., 1954.

The author examines the existing theories relating to the phenomenon of disease (notably that caused by fungi, viruses and bacteria) as it affects populations of insects, reviews some of the literature concerning it, gives some results of original laboratory and field observations and discusses the characteristics of disease as a factor in natural control. He deals with the variations of disease prevalence in time and the parts played by the infecting agent, the insect host and the environment in determining the initiation, rise and decline of an epizootic, and discusses in detail the extent and manner in which disease is density-dependent; the extent to which epizootics and their effects are influenced by weather conditions; how nearly a disease can eradicate a given population of insects, and whether it can give prolonged or permanent natural control; what effect disease has on other density-dependent control factors, such as insect parasites and predators, and the relation of mode of transmission or dissemination of a pathogen to the epizootiology of disease in insect populations. An account of the types of relationship existing between micro-organisms and insects is appended.

Papers noticed by Title only.

Vappula (N. A.). **Finnish Entomological Literature published in 1953, including** [titles of papers on] **Economic Entomology and Control of Insect Pests.**—*Ann. ent. fenn.* **21** no. 3a 18 pp. Helsinki, 1955. [*Cf. R.A.E.*, A **43** 128.]

Riddick (E.). **A List of Florida Plants and the Scale-insects which infest them.**—*Bull. St. Plant Bd Fla* no. 7, 78 pp., 13 refs. Gainesville, Fla., 1955.

Day (M. F.). **Parasitological Reviews. Mechanisms of Transmission of Viruses by Arthropods.**—*Exp. Parasit.* **4** no. 4 pp. 387–418, 3 figs., 8 pp. refs. New York, N.Y., 1955.